RAILROAD GAZETTE

FRIDAY, SEPTEMBER 1, 1899.

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Contributions.

The Heytor Granite Tramway.

London, Aug. 18, 1899.

To the Editor of the Railroad Gazette:

There is a slight omission in your account of this curious work, in your issue of July 21. It says "At Newton Abbot the line crosses another stream." This should be "At the Newton Abbot high-road." "Dartmore" should, of course, be "Dartmoor." Waithman obelisk 1833, not 1835. W. B. PALEY.

Is the Passenger Train Shed a Mistake?

Orange, N. J., Aug. 29.

To the Editor of the Railroad Gazette:

Your editorial last week entitled "Is the Passenger Train Shed a Mistake?" introduces a question of great interest. It is not probable that any one answer will satisfy the question for all time, for no doubt some sheds are a mistake while others are not.

The writer would go a step farther than the article mentioned above, and state as a general proposition that all low train sheds are a mistake and that a railroad in the selection of a covering for its terminus has the choice of two rational constructions: either a high train shed (75 ft. or more) or the use of awnings. The awning is decidedly preferable to the low train shed, and there is no excuse for the latter in this climate under any circumstances. It would be easy to mention a number of low train sheds—some built many years ago, and others quite recently—which are extremely dingy and disagreeable. Probably the greatest mistake of this kind that has been made during the last decade is the North Union Station, at Boston, Mass., which is so low that passengers are within easy sight of the grimy trusses, and the whole effect is that of a dark cloud overhanging. There can be no question that light and airy awnings would have been better than the structure built, and at a fraction of the cost.

On the other hand, there are places where a great train shed is almost necessary to fit its surroundings. Thus the simple awning would not compare with the present arch at Grand Central Station. A great train shed adds dignity and solidity to a railroad. This gives its patrons greater confidence and good will, which though not tangible assets, certainly should figure in a road's standing. Thus, if we consider the terminals of the Pennsylvania and Erie Railroads in Jersey City, one is forced to the conclusion that the former is vastly more careful in its service and makes more of a point of pleasing its passengers. The great train shed of the Pennsylvania gives a "tone" to that road which other roads terminating in Jersey City do not have, and other things being equal, a great many people will choose to travel by that road in preference to all others.

It is probable that the great train shed may be more easily maintained in the future than it has been in the past. The step of the Boston & Maine in introducing coke as a fuel for its engines may be only the fore-runner of a gradual movement eliminating the smoke nuisance. And the probabilities are that some paint will be found or has been found which will better protect such structures.

However, though a train shed may sometimes be an unwise expense, it would be better for the railroads to put their money into such structures than to run too many "limited" trains with five or six persons in a car. The handsome train shed pleases a greater number of people, and it is also more durable. HERMAN CONROW, C. E.

Train Orders by Telephone.

To the Editor of the Railroad Gazette:

An article by the well-known authority on railroad electrical apparatus, Mr. Geo. W. Blodgett, in your issue of July 28, on "The Telephone in Railroad Service," attracted my attention and awakened no little interest, for the reason that, while Superintendent of the Boston, Revere Beach & Lynn Railroad, I had a telephone system of train orders which necessity compelled me to devise, surrounding it with such safeguards as my experience suggested, including a special code of rules which were afterward incorporated in the Book of Rules and Regulations.

I used this home-made system in my obscure corner, not far (you can't go far in Boston without running into something worth while) from Mr. Blodgett's headquarters, for some eight or ten years, and grew to have the greatest confidence in the system, using it for all kinds of train orders—changing meeting points, running extra trains, fixing schedule for same, sending relief in case of breakdown or other emergency, or handling the entire train and ferryboat service on a trying day of summer excursion business, regardless of time-table. So far as I know, the system is still in force, though with the completion of double tracking there is far less demand upon it. No accident ever attended its use and, although thousands of orders were issued, I cannot remember a mistake in the transmission of any to which "O.K." was given; certainly not in any essential particular. Even the initials of names and the number of the order (which was one of the first words transmitted) came out correctly. Care was taken, of course, to ensure this; in case of any doubt, speaking the preceding numerals, or letters of the alphabet, till the right one was reached, worked well.

I could fill many columns (but I will not thus weary you) with my experiences at the 'phone, to which, one more than one long day, have I been a martyr—to the ruin of a naturally sweet disposition; for, under no circumstances would I allow myself to authorize "O.K." until I was sure the repeated message *was* O.K. At first we only had the "ground" circuit, which did well enough till the advent of the electric light and the electric railway, when the strident din of shrieking, buzzing, clattering noises nearly choked utterance (from the other end). But it is wonderful how we can train our special senses to work under difficulties. You may scarcely believe it, but more than once have I given an important order ("regardless of time-table") to a waiting train, when my operator's voice at some distant station sounded almost as far away as he was—just a faint whisper, amid a perfect Babel or bedlam of telephonic "induction" screeching, like a fine silver thread running through a barbaric patchwork; and that order, with the engineman's greasy and smutty marks upon it (the order, usually addressed to the conductor, was to be carried by the engineman till executed) came in to me, the next morning, to be compared and found correct, word for word, with my own copy written at the time of sending, for I allowed myself to transmit no train order until I had first written it out on one of my own special blanks, a little pad of which I always carried.

With the introduction of the metallic circuit and improvements in the transmitter, the telephone service, with reasonable care in maintenance, became almost ideally perfect. Dictation and repetition were under practically the same conditions as if the two persons—sender and receiver—were both in the same room; the pen-scratching, noises around the station, a passing train, ringing of engine bell, or a whistle signal in the yard, were often audible (but not annoyingly so) in the hall of the Superintendent's house, miles away, and lent an indescribable sense of propinquity. There was never any need of saying: "Who are you?" The voice of each was instantly recognized by the other, and the personal peculiarities of tone and enunciation were clearly (and, at times, ludicrously,) reproduced by the faithful instrument. Words spoken by telephone seemed to linger in the memory longer than when by voice direct, and there were times when it seemed that even the tingling of the ears could be felt through the wire!

Mr. Blodgett is quite right in his statement of some of the advantages of the telephone over the telegraph. It is true that the telegraph can make its record at the other end; but the apparatus for that purpose is never provided, and sound is relied upon in each case; the transmitting in one case being done by hand, and in the other by the quicker-moving tongue—the ear by the former method (after long training) catching arbitrary sounds, and by the latter the living words themselves. In cases where a five minute delay of train or boat during rush hours threatened to derange the whole schedule, the superior quickness of the telephone was invaluable. Question and answer flew with lightning rapidity, the situation was understood in a few moments, and the proper orders were given and made "O.K." within a minute.

It was not by mere chance that good results were thus continually obtained, but through rigid discipline, as binding upon the sender as upon the receiver of a "Telephone Order." A certain prescribed method, plainly set forth in the book of rules, was invariably followed; any tendency to deviate from this, or any indication, even though slight, of a lack of familiarity with the governing rules, brought an immediate reprimand, and a second caution was seldom necessary.

The practice I adopted for issuing train orders by telephone, and adhered to without change for years, was substantially as follows: In the first place, the Superintendent had to do all his dispatching himself, and so gave all train orders, except that, in his absence, one other person was authorized to do so under certain limitations. As before stated, he had one inseparable companion and was never without it—a little pad of blank forms for telephone orders, inserted in morocco covers about 3½ by 5 in., round corners, printed on pink-tinted paper, each pad containing 50 leaves consecutively numbered on blank and stub, the latter showing to what station and agent the message was sent. The blank for the receiving agent's use was a little larger, about 4 by 6½ in., including stub, printed on yellow-tinted paper of good quality, 100 in a pad. At the bottom of the blank was printed the following certificate: "I hereby certify that the above message was received by me by telephone from C. A. Hammond, Superintendent, and that I repeated it to him and he replied ( ). —— ——, Agent." After the words "he replied" a space was left, enclosed by a circular line, and when the Superintendent's "O.K." was received (after the entire message, including signature, had been repeated back to him by the agent), the letters O.K. were plainly written by the agent within the circle, as a part of his certificate, to which he then signed his own name. If the "O.K." was not given, or if the line failed just as it was about to be sent, the order was void, and in no case would an engineman take it, however great the need of it; nor would he receive it unless the agent had signed his certificate, as above; whereupon the conductor (to whom the order was usually addressed) signed his name to the agent's stub, which read thus: "I have received from —— ——, agent at ——, telephone order No. —. —— ——." In the case of a light engine, the engineman signed for the order, which would be addressed to him. Having received the order, it was read by the conductor and engineman, carried by the latter until fulfilled, and turned into the Superintendent's office the next day, where it was compared with the Superintendent's original order, pinned to it, and then filed away.

It was never found necessary for the conductor or engineman to repeat by telephone to the Superintendent an order they had thus received from him. It was required to be plainly written in ink by the agent, and when properly certified to, was then to be obeyed like any other written order; but no order was to be obeyed unless fully understood, beyond doubt. After delivery, the agent was required to telephone to the Superintendent: "I have delivered telephone order No. — to —— ——, conductor of train No. —." Great care was taken to have the method described above strictly carried out to the last detail. The whole process was clearly described in the book of rules and regulations, so that a new operator would know as well what to do as the oldest.

Not only was the system of giving train orders by telephone satisfactory to the Superintendent, in its practical working, but—what was of equal importance—the employees themselves, especially those whose duties were affected by it, had implicit confidence in it. A telephone order bearing the Superintendent's name signed to it, together with the agent's certificate, and which they themselves had signed for and understood, had, in their eyes, more than ordinary authority. This was emphasized, perhaps, by General Rule 104, which read: "A white flag or light will be carried on the front of the engine of any regular train which is moved by special orders."

The duplicate system of train orders was not used; it could be easily applied, however. Telephone operators were required to keep the Superintendent promptly advised of delays and irregularities in train movements, and one of the most frequent directions sent to them by telephone was, "Call in the conductor of train No. —." Often both conductors were thus corralled and told what orders were presently to be given them.

Not seldom, during a heavy day, the regular schedule became so far departed from that the whole road was run by telephone until the last train had made its trip and the last engine was put up. Then the Superintendent would drag home, about 12.30 a. m., only, perhaps, to be awakened by the telephone bell in his chamber at about 5.30 a. m. to listen with blinking eyes to the unusually distinct announcement that "Loco. No. 5 has been derailed on turntable and blocked up all the other engines in round house." And then he would stand, with time-table outspread and his little telephone order pad on the little desk below that malicious instrument, thinking big thoughts, planning expedients, getting information and a deluge of reports, fighting a way

out of a difficult situation, calling up reserved forces, sending out relief engines (if he had any), and finally keeping delayed trains and boats moving and connecting with each other, changing meeting points and train numbers, annulling or running extra trains, until the mid-forenoon lull allowed him to get fully dressed and eat his breakfast. The telephone is a wonderful instrument!

C. A. HAMMOND.

Virgilina, Va., Aug. 10, 1899.

Some Results of the Use of Tonnage Statistics.

The diagrams show the improvement that has been realized on the Southern Pacific in car and locomotive service in 10 years as a result of trying systematically to watch and control the relations between engine-miles run and ton-miles performed. It will be seen that on the Pacific system of that company the ton-miles per car owned were 110 per cent. more in 1898 than in 1889 and that the average carrying capacity per car was about 17 per cent. greater and the miles run per car about 45 per cent. more. In the same time the ton-miles per car owned, for all the railroads of the United States, had increased only about 15 per cent. Again, looking at the diagram showing locomotive service, we find that on the Pacific system the ton-miles hauled per locomotive owned increased about 93 per cent. The miles run per locomotive increased about 36 per cent., and the average hauling capacity of locomotives about 17 per cent. But on all the railroads of the United States the ton-miles hauled per locomotive increased in that time something like 4 per-cent.

In explanation of this result we cannot do better than to print the original documents sent to us by Mr. Kruttschnitt. These we publish nearly in full, but have made a few excisions to save space. Of the various blanks we give only the headings and necessary explanations for their use.

We judge that this practical example of the use of ton-mile statistics as a means of economy is important enough and instructive enough to justify the space which we give to it; and we assume that the reader will be as much interested in the details as we have been.

The first document is a letter from Mr. Kruttschnitt, dated July 1, 1899, which explains the whole matter.

"In your issue of June 23, we have noted and read with much interest on pages 454 and 455, your editorial comments on the report of a Committee of the Master Mechanics' Association on a ton-mile basis for motive power statistics. Thinking that the practical workings of such a system on the lines of the recommendations made by the Committee might be of interest to you and your readers, I inclose you a copy of our form 2 TF 305, the use of which was begun on July 1, 1897, and which has therefore been exactly two years in use at the present time. This form is a tabulation of the operating results on all of our divisions, issued monthly for the information of superintendents only. It is obviously not intended for general distribution and, for that reason, on the copy sent you we have shown the columns 16 to 24, covering the actual cost of certain items of transportation, blank; but this in no wise detracts from the value of the sample. Circular letters of March 19 and April 1, 1898, explain, in perhaps more detail than would be necessary for one thoroughly versed in railroad accounts, the methods of computing the results shown in the different columns.

"We also inclose you the forms used in reporting gross tonnage of trains, coal consumption, etc., and a sample of the report rendered by Superintendents at the end of each month. The inclosed circular of January 18, 1898, with form TF 3, will illustrate the watch that is kept by managers on the efficient use of motive power.

"Two blue-prints are attached, which show for the two Southern Pacific systems, the comparative service got out of freight locomotives and freight cars, for a period of ten years; the ton-miles of freight handled per locomotive; miles run per locomotive; average hauling capacity; ton-mileage of freight per car; miles run per car owned, and average carrying capacity, all being rated as unity in the year 1889. At the bottom of each sheet are shown corresponding data for all the railroads of the United States, tabulated from the reports of the Interstate Commerce Commission in so far as it was possible. The prints show much better than language what has been accomplished.

"We find the interest excited among our Superintendents by the distribution of these statistics growing all the time, and it is thoroughly understood that, while no two divisions are exactly similarly situated, there is a constant incentive for a man to improve his own record in comparison with the previous year, as shown in columns 31 to 35 of our statistical form. While the train load depends largely on volume and direction of traffic, we find under average conditions, both car and train loading constantly increasing, as well as the service obtained per locomotive and per freight car."

Circular Letter of March 19, 1898.

In investigating variations in train loading shown on confidential statement 2 TF 305 sent out monthly, we find that the methods of reaching the results shown on this form are not clearly understood, and, with a view of making the matter plain to all, your attention is invited to the following explanations:

Column 2, Total Freight Train Mileage, is obtained from the Car Accountant, and represents the total mileage of regular locomotives drawing freight trains with light and helper mileage run in connection therewith, as reported daily by your offices to the Car Accountant. Anything, therefore, that increases light or helper mileage, no matter how well trains are loaded, increases your divisor and reduces your quotient or tons of revenue freight per train.

Column 3 shows the total ton mileage or revenue freight, including company freight, passing over the division, computed by the Freight Auditor.

Column 4 shows the gross ton mileage of freight trains, including freight carried as well as the weight

Daily Report of Coal Consumed by Engines Arriving. (2. T F 198.)

At ..... *Station* 189

Engine.	Arrived			Pounds Coal Used on Trip	Engineer	Fireman
	On Train Number	From	Time			
1	2	3	4	5	6	7

This report must be compiled by Roundhouse Foremen from engineer's trip coal report form No. 2 T. F. 197, and must be sent daily by Roundhouse Foremen to the Superintendent.

(2 T F 194)

Conductor's Tonnage Manifest.

Train No..... Rating No..... .....Rating in Ms..... .... Conductor.

Engine.		From	To	Engineer	Fireman	Coal Consumed, Pounds (To be filled in by Supt.)
Initial.	Number					

Car		Taken From	Left at	Miles	Gross Wght. Cars and Contents, Ms.	Allowance for Light Loads Ms.	Ton Mileage [To be filled in by Supt.]
Initial	Number						
1	2	3	4	5	6	6½	7

Total ton miles per trip.....

(Back of 2 T F 194.)

Freight Loaded Into Cars by Conductor.

Car		Freight Taken at	Freight Carried to	Miles	Amount Loaded Ms.	Ton Mileage (To be filled in by Supt.)
Initial	Number					

Total ton miles freight loaded by Conductor.....

Instructions.

1. Conductor must enter, in proper column on this blank, car weights taken from agent's train list, Form No. 2 T. F. 195, to be handed him at terminals and at stations where cars are picked up on the trip. If cars are picked up at stations where there are no agents, Conductor must himself compute gross weight of car and contents, using weight stenciled on car and the best estimate he can form of the contents.

2. The following allowance for light or unloaded cars must be inserted in column 6½ and must be added to the actual weights given in column 6 when loading the locomotive up to its rating, but must not be considered by the Superintendent in recording ton mileage:

For gross weight of car and contents (in column 6)	Allowance to be made (in column 6½)
Less than 30 Ms.	6 Ms.
From 30 to 40 Ms.	5 Ms.
From 40 to 50 Ms.	4 Ms.
From 50 to 60 Ms.	3 Ms.
From 60 to 75 Ms.	2 Ms.
75 Ms. or over	Nothing.

3. Where actual weights cannot be ascertained, estimated weights must be used, as provided for in table below.

4. Weight of freight loaded into cars by Conductor must be entered on back of blank, in columns provided for that purpose.

5. Show all weights to nearest 1,000 pounds using letter "M" to indicate 1,000 pounds; lots of less than 500 pounds will be dropped, and lots of 500 to 1,000 pounds to be counted as one "M."

6. Conductor must enter the caboose, by initial and number, last on the list, rating it at the arbitrary weight of 30 Ms (30,000 pounds).

7. If from any cause cars are cut out short of destination, Conductor must so note under head of "Remarks," giving number and initial of car. If freight is transferred, show initials and numbers of cars from and to which transferred, with approximate weight of freight.

8. Conductors must add to actual weights of passenger cars of all classes 6 Ms to provide for loads in such cars, except where cars are moved "dead head" or empty, and must insert the total weight of car, including such allowance, in column 6.

9. If the number of lines on this blank is not sufficient to enter all cars on train, use a second blank, filling in headings as on the first.

10. This report must be sent by Conductor to Superintendent at the end of each trip.

Table of Estimated Weights.

Take for Unstenciled Cars:		Load in each passenger car	6 M.
Oil Tanks	40 M.	Pullman sleeping cars	90 M.
Refrigerator	40 M.	Dead engines 8-wheel	150 M.
Caboose	30 M.	" " 10-wheel and mogul	200 M.
Flat	20 M.	" " 12-wheel and consolidation	225 M.
Coal	22 M.	Lading in refrigerators	25 M.
Box	26 M.	Lading in way freight	10 M.
Furniture	28 M.	Hogs in double-deck cars	25 M.
Common Stock	30 M.	Hogs in single-deck cars	15 M.
Stable and double-deck stock	32 M.	Sheep in double-deck cars	20 M.
Arms Palace horse	40 M.	Sheep in single-deck cars	10 M.
Coaches, tourist, baggage	50 M.	Horses and cattle, carloads	20 M.

Note.—On other freight, if actual weight cannot be obtained, it must be carefully estimated.

(T F 3.)

Tonnage Rating.

Daily Report of Locomotive Performance.

Instructions—This report must bent to the Manager daily, and must include all freight trains for which ratings have been established. In column 1 should be shown the terminals between which trains are run; in column 2, the train number, denoting an extra by an "X." Column 4 represents the ton mileage which the engine is rated to pull, and column 5 the actual ton mileage hauled as reported by the conductor on blank 2 T F 194; this ton mileage in each case should be the weight of train only, excluding locomotive and tender. Give brief reasons for underloading under head of "Remarks." Eastbound trains should be grouped separately from westbound, and the division totals should be computed and placed at the bottom of the sheet.

Division ..... *Supt*..... 189

Between	Train No.	Engine No.	Potential Ton Mileage.	Actual Ton Mileage.	Remarks.
1	2	3	4	5	6

Totals
East
West
East and West

Percentage of efficiency.

Divide total of column 5 by total of column 4 to secure the percentage of efficiency.

of cars and engines, reported by Superintendents on the monthly reports of tonnage rating performance.

Column 5 shows total coal consumed by freight trains shown on the same report.

Columns 6, 7 and 8 are obtained by dividing the locomotive mileage by the amount of coal, lubricating oil and waste used.

Columns 9 and 10 show the average number of cars in each train, ascertained by dividing the total mileage of loaded and empty freight cars as rendered by the Car Accountant, by the total train mileage as shown in column 2.

Column 11 shows the average car load, ascertained by dividing the revenue ton mileage of freight in column 3 by the loaded car mileage furnished by the Car Accountant.

Column 12 shows the average load of freight in a train, ascertained by dividnig column 3 by column 2.

Column 13 shows the average gross weight of a train, including freight, dead weight of cars and locomotive, ascertained by dividing column 4 by column 2.

Column 14 shows the service got out of coal, as reported by Superintendents monthly.

Columns 18 to 23 show the cost per 100 gross ton miles of locomotive service and trainmen, ascertained by dividing the total cost of the items named by the gross ton mileage shown in column 4.

Column 24 shows the total cost per 100 revenue ton miles, obtained by multiplying column 23 by the ratio of gross to revenue freight, this ratio being column 4 divided by column 3.

Column 25 shows the average number of locomotives in service, excluding those in shops.

Column 26 is ascertained by dividing column 2 by column 25.

Column 27 is ascertained by dividing column 4 by column 25.

Column 29 represents rise and fall of grades, divided by miles of road operated.

The final test of the efficiency of your management is summed up in columns 12 and 24, or, more tersely still, in column 24 alone, every other column of the blank contributing in some way towards the result shown in the total cost of moving freight per 100 revenue ton-miles. The commodity we have for sale is the transportation of freight, quoted at so much per ton-mile selling price. That part of the cost which immediately reflects the success of your management or the reverse (which is by no means the total cost, however) is given in column 24; and the prosperity of the company obviously depends on the margin between the selling price of transportation and its cost. It is earnestly hoped that, with these explanations, every effort will be made to keep column 24 down as low as possible.

Circular Letter of April 1, 1898.

Since explaining the methods of computing the statistics on blank 2 TF 305, further study of these reports from July to January inclusive, has convinced me that the poor showing made on some divisions is caused by losing sight of the fact that the tons of revenue freight per train and the loaded cars per train are profoundly affected by the results in column 2, or total freight-train-miles, which is the same as the miles run by engines in freight service, whether pulling loaded trains, running light or helping.

On the three divisions of heaviest tonnage, to-wit: the Western, Salt Lake and Tucson, the loaded cars per train show a steady fall from about the month of November to date, the four months preceding November having been extremely satisfactory. The car-loading having remained reasonably constant, the fall in revenue tons per train is almost wholly attributable to the fall in the number of loads hauled.

Every additional mile run by a helper in pushing or helping over grades where one engine can do the work, every mile run by light engines, increases the amounts in column 2 and decreases those in columns 9, 12 and 13. Each Superintendent should study most carefully the grade conditions on his division, taking off or putting on helpers whenever by so doing he can reduce the total number of engine miles run to handle the traffic. Fearing possibly bad showing on the daily report of efficiency in the use of motive power it may happen that an engine is run light over a division at times when it might be utilized to haul company freight or a light load of revenue freight. Whilst the light loading of such a train might require explanation, the general average of train loading is raised by making the engine haul a small number of tons instead of none. The helper stations should be carefully studied out with a view of making the engine miles run each day for a given amount of traffic a minimum. Under these conditions we shall attain the maximum economy.

To make my meaning clear, we will take two examples:

Suppose a division 100 miles long has a thousand tons of freight to move from one end to the other. The capacity of locomotives over 80 miles of the division is 200 tons, and for a distance of twenty miles there are grades that limit their loading to 190 tons, but, by the addition of a helper, the load over the grade can be raised to 220 tons. The question before the Superintendent would naturally be: Which is the more economical—to start the engines from the terminal with such a load that they can surmount the grade, or stop them at the foot of the grade and attach helpers, it being borne in mind that, on account of schedules, the helpers have to double

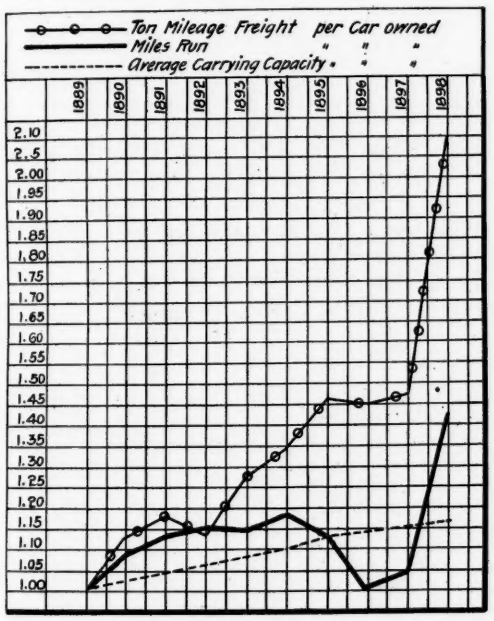
CONFIDENTIAL TABLE ISSUED MONTHLY TO SUPERINTENDENTS—SOUTHERN PACIFIC RAILWAY.

Statistics of Freight Train Service for the Year Ending June 30th, 1898. (2 T F 305.)

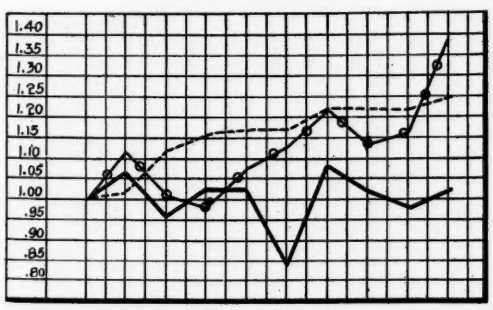
Miles of Road Operated.	Total Freight Train Mileage.	Total Ton Mileage (thousands). Revenue Freight.	Total Ton Mileage (thousands). Gross Weight Train.	Tons Coal Consumed.	Locomotive Miles Run. Per Ton of Coal.	Per Pint Lubricating Oil.	Per Pound of Waste.	Cars per Train. Loaded.	Cars per Train. Empty.	Tons Revenue Freight. Per Loaded Car.	Per Train.	Gross Weight of Train (tons).	Gross Ton Miles per Pound Coal	Division.	Number of Locomotives in Freight Service.	Average Miles Run per Freight Locomotive.	Ton Miles (work done) per Locomotive (thousands).	Per Cent. of Actual Train Load to Tonnage Rating of Locomotive.	Average Ascents and Descents of all Grades per Mile of Road (feet).	Percentage of Branch Lines to Total Road Mileage.	Comparison with Previous Year, + Increase % — Decrease %. Car Load.	Revenue Train Load.	Mileage Done by Each Locomotive.	Work Done by Pound of Coal.	Cost of Service per 100 Reven. Ton Miles.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	25	26	27	28	29	30	31	32	33	34	35
																		Last 6 mos.							
834	1.392,872	373,258	915,756	70,503	19.8	20.3	92	17.84	5.23	15.02	268	657	6 49	Western.	32	43,527	28,616	57	14	42	+3	+7	+4	—2	—13
557	1,458.530	258,318	793,782	76,655	19.0	19 7	85	12.84	4.51	13.79	177	544	5.18	Sacramento.	35	41.672	22 679	79	29	24	+3	+2	+9	+6	—5
205	231,627	31,932	101,158	10,179	22.8	17.5	69	11.05	4 33	12.47	138	437	4.97	Shasta.*	7	33,090	14,451	93	52	0	—4	—2	+17	+3	—5
556	2.410,308	531,392	1,483,712	128,165	18 8	23.9	160	14 96	5.54	14.74	221	616	5 79	Salt Lake.	46	52,398	32.255	94	23	0	—1	+9	+10	—15	+6
710	1,670,365	313.336	841,940	83.360	20.0	20 3	69	12.29	4 13	15.27	188	504	5.05	San Joaquin.	35	47,725	24,055	76	25	49	+5	+7	+4	+3	—4
430	920,884	204,982	533.690	46 333	19 9	18.8	81	13 66	4 23	16.30	223	580	5 76	Los Angeles.	23	40,038	23,204	83	29	39	+7	+29	—3	+2	—17
564	1,877,169	458,291	1,089,180	92.763	20 2	20.5	105	14.43	5.11	16.92	244	581	5.87	Yuma Tucson.	34	55,211	32,055	84	23	0	+8	+24	+12	—	—19
630	639,279	82.535	250,571	22 276	31.1	23.8	123	9.51	4 29	12 52	119	361	5 62	Lines in Oregon.	17	40,781	14,739	45	25	46	+13	+18	+8	—14	—14
381	429,396	56,826	173,074	19,634	21 9	22.5	78	11 62	5.79	11 39	132	403	4 41	Coast (Standard Gauge).	11	39,036	15,734	40	27	19	—6	+4	—0	+15	—12
101	85,702	9 652	21,545	2,924	29.3	30.1	122	11.72	5 20	9.60	113	251	3.68	Coast (Narrow Gauge).	3	28,567	7.181	..	24	21	—4	+15	+0	+19	—12
274	726,573	204,290	517,892	29,895	24.3	24.0	109	20 37	6.81	13 80	281	713	8 66	Morgan.	20	36,329	25,894	65	1	50	—2	+22	—17	—3	—12
363	949,329	282,690	664,472	43,129	22.0	25 3	89	19.96	7.34	14.92	298	709	7.70	Louisiana.	21	45,206	31,642	64	7	24	+3	+23	—9	+1	—17
463	1,681,216	352,755	867,591	75,332	22.3	28 0	112	12 66	5.41	16 56	210	516	5 76	Houston.	32	52,538	27,112	76	20	18	+8	+14	—2	+7	—19
456	1,335,477	320,301	788,220	80,420	16.6	22 3	119	13.40	5.12	17.90	240	590	4.90	El Paso.	22	60 704	35,828	83	28	0	+4	+17	+1	+6	—15
242	128,813	13 565	50.296	5,262	24.5	16.4	36	10.04	5 50	10.49	105	390	4.78	Victoria.	3	42,938	16,765	51	9	15	+3	+12	—2	—5	—10
4966	11.170 135	2,529,987	6,205,088	552,792	20.2	21.1	96	13.87	4.99	15 04	209	556	5 61	Pacific System.	243	45,968	25.535	78	25	27	+4	+11	+7	—4	—9
1759	4,821,408	1 181,226	2 888,471	234,038	20 6	24 7	102	15.40	5.92	15.91	245	599	6 17	Atlantic System.	98	49,198	29,474	72	15	19	+4	+17	—5	+3	—15
6725	15,991,543	3,511,213	9,093,559	786,830	20 3	22.2	98	14.33	5.20	15.32	220	569	5.78	Total.	341	46,896	26,667	76	22	25	+4	+12	+2	—2	—10

Cost of coal per ton—Pacific system, $4.395; Atlantic system, $2.86.
" " wood " cord " " 3.009; " " 1.87.
Mixed trains divided ¾ to freight and ¼ passenger.
1¼ cords wood assumed equivalent to 1 ton coal.
200 gals. fuel oil " " 1 "

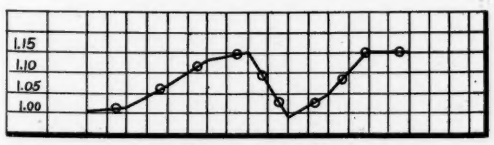
*Shasta Division abolished March 20th, 1898.
Traffic on Atlantic system interrupted by quarantine restrictions, September to November, 1897.



S. P. Co.—Pacific System.

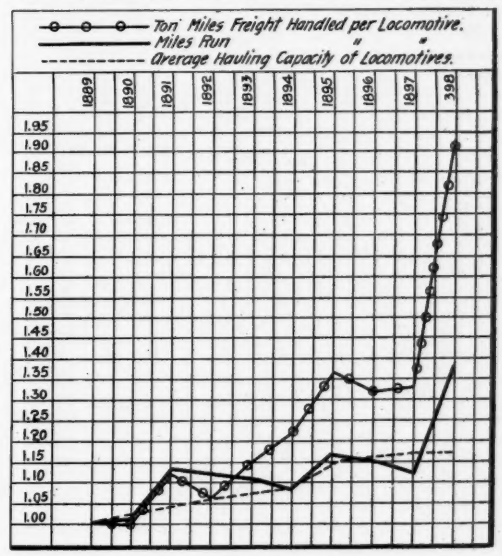


S. P. Co.—Atlantic System.

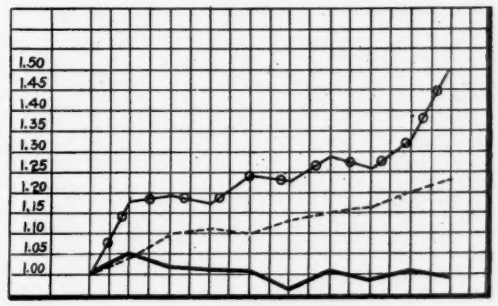


All Railroads—United States.

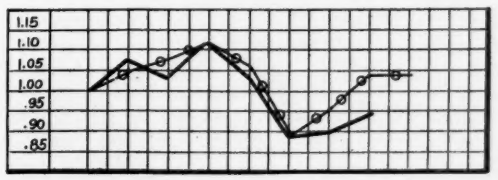
Comparative Service of Freight Cars.



S. P. Co.—Pacific System.



S. P. Co.—Atlantic System.



All Railroads—United States.

Comparative Service of Freight Locomotives.

light? Under the first assumption, if the engines are started out of the terminal with 190 tons each, the movement of the traffic will require 530 engine miles. If they are started at the terimnal with 200 tons and trains are broken up so as to haul

(2 T F 135.)

Train List.

.....Division.

Train No.....

Leaving .....

at.....m. 189

Initial	Car No.	Destination	Gross Weight Car and Contents Ms.
1	2	4	6

(Back of 2 T F 195.)

Instructions.

1. Agents must fill out this blank and hand to conductors for all cars leaving their stations.
2. Lading in way freight cars will be assumed as 10,000 pounds, or 10 Ms.
3. Weights must be taken from way bills and from tare stenciled on equipment whenever possible. Otherwise use estimated weights, as provided below:

Tare for unstenciled cars:

Oil tanks	40 M.
Refrigerator	40 M.
Cabooses	30 M.
Flat	20 M.
Coal cars	22 M.
Box	26 M.
Furniture	28 M.
Common stock	30 M.
Stable and double deck stock	32 M.
Arms palace horse cars	40 M.
Coaches, tourist, baggage, mail and express	50 M.
Pulman sleeping cars	90 M.
Dead engines: 8-wheel	150 M.
" 10-wheel	200 M.
" 12-wheel and consolidation	225 M.
Lading in refrigerator cars	25 M.
Lading in way freight cars	10 M.
Hogs in double-deck cars	25 M.
Hogs in single-deck cars	15 M.
Sheep in double-deck cars	20 M.
Sheep in single-deck cars	10 M.
Horses and cattle, carloads	20 M.

On other freight, if actual weight cannot be obtained, it must be carefully estimated.

4. Show all weights in Ms (one M meaning 1,000); less than 500 pounds to be dropped; 500 to 1,000 pounds to be counted as one M.

(2 T F 196.)

Weight Tag.

From .....Station

Car No.....Initials.....

Marked weight .....

Destination of Way-Bill.	Weight as per Way-Bill.

(Back of 2 T F 196.)

Instructions.

1. All single way-bills made for car load lots must show in separate items the marked weight of the car, the weight of the load and the amounts combined.
2. Where there is more than one way-bill for a car, this weight tag must be made out showing the weight of load given on each way-bill, the marked weight of car, and these amounts combined. This tag must be fastened to way-bills and kept with them.
3. Where way-bills come from other divisions and weights of car and load are not shown theron, terminal agents must make proper entries upon way-bills and weight tags.
4. Way cars with freight to be unloaded at various points on the division, will be arbitrarily assumed to contain 10,000 pounds, or 10 Ms.

(2 T F 197.)

Trip Coal Report.

.....Station 189

Engine No.....on Train No.....

Left with.....pounds coal.

.....R. H. Fmn.

Took on at

.....Stn.....pounds coal

.....Stn.....pounds coal

.....Engr.

Arrived .....Station

with.....pounds coal.

.....R. H. Fmn.

Net amount consumed on trip,

.....pounds coal.

(Back of 2 T F 197.)

Instructions.

1. This blank must be handed engineer leaving terminal, by Roundhouse Foreman, and must be turned over by him to Roundhouse Foreman at end of run.
2. The "net amount consumed per trip" should be the sum of amount on engine at starting point, and that taken en route, less the amount on tender at end of run.
3. From data shown on this blank, Roundhouse Foremen must make up their daily report to the Superintendent of coal consumed by engines arriving at their stations, Form 2 T F 198.

Record of Work Done by Enginemen During the Month of Feb., 1898. (Louisiana Division).

Freight Service.

No.	Engineer.	Ton Miles per Lb. Coal.	Fireman.	Eng.	Total. Ton Miles.	Total. Lbs. Coal.
1	Burts ..	14 02	Aldis	709	92.413	6,600
2	French ..	9 41	Rayburn..	623	2,870,725	304,900
3	Wilson ..	8.67	Fredricks.	628	2,727,905	314,600

....., Superintendent.

220 tons over the grade with the helper, which has to double light, the number of engine miles necessary to move the traffic over the division is 520 or 50 miles more than under the first assumption. It is clearly, therefore, not profitable to work this division with a helper station,

As another example, take the movement of empty flat cars westbound in order to obtain eastbound loads. We will suppose 30 cars of steel rails, with 20 tons to the car, moved out of El Paso to be unloaded about Tucson; the empty flats to be moved westbound to Port Los Angeles, where they are to be loaded with cross ties for the El Paso Division. This is a movement that is going on at the present time. To move the 30 cars of rails to Tucson requires the expenditure of say 312 engine miles; the ton mileage is 137,200. The capacity of the engine is supposed to be 40 empties, which we will suppose first to move back to El Paso without loads. Thirty empties consuming but ¾ of the power of the engine, is equivalent to using her entire power for ¾ of 312 miles, or 224 miles. The average train load will, therefore, be: Total ton mileage of 137,200, divided by 312 westbound and 224 eastbound, or 536 total, or an average of 350 tons. If the flats are moved to Port Los Angeles, 312 engine miles are made to move the loads to Tucson as in the first case, and ¾ of 521, or the mileage from Tucson to Port Los Angeles, in moving them empty; total, 702 engine miles westbound. The cars being loaded with ties, are moved east with an expenditure of 833 engine miles; the ton mileage of freight moved is 499,800. This, added to the 137,200 ton miles of rails moved westbound, gives a total of 637,000 ton miles, which, divided by the total engine miles of 833, plus 702, or 1535, giving an average train of 447 tons, or nearly 100 tons more than in the first case; proving the economy of what we are doing every day.

I am convinced from intercourse with Superintendents that every effort is being made to increase the train loading and that the failure of some of them to attain better results is due more to misdirected effort than lack of zeal. Whilst these explanations are particularly addressed to them, they are sent to all in the hope that the light thrown on the methods of reaching average results, which are those by which we are judged, will lead to a closer investigation of questions of reducing engine service and to increasing train loads.

Circular Letter of January 13, 1898.

As a more efficient check on the use of motive power by division offices than is afforded by the present method of computing the tonnage of trains leaving terminals, which does not take account of cars picked up or dropped on the trip, Superintendents should report on form T.F.3, commencing February 1, 1898, in addition to the actual ton-mileage, the total possible ton-mileage that the locomotives could handle on a trip between terminals. This total, which will be called "Potential Ton Mileage," is obtained by multiplying the tonnage rating of the locomotive between the terminals in question by the mileage on distance run. This should be entered in column 4 of blank T.F.3.

To save labor, the potential ton mileage of the different classes of engines between terminals on each division can be computed and entered in tabulated form somewhat as outlined below:

Potential Ton Mileage of Locomotives.....Division.

Class.	Oakland-Sacramento.	Oakland-Mendota.	Oakland-Fresno.
D. A.,	192,950	388,170	458,540

With a table of this kind, the data for any engine can be picked out and entered on the blank. The weight of locomotives and tenders should not be included in either the actual or potential ton mileage reported on blank T.F.3.

Pile Driving Formulas.

Under this title Mr. Charles H. Haswell has prepared a paper which appears in the May issue of the Proceedings of the American Society of Civil Engineers, in which, after reviewing and criticising some of the standard pile-formulas most in use, he presents for the consideration of the engineering profession a new one, devised by himself, that he claims is at once more rational and more nearly practically correct in its results.

Before proceeding to discuss his reasonings and citations, it may be best to give the formula and point out its distinguishing characteristics. In its primary state it is as follows:

$$\text{Safe load} = \frac{4\,w\,\sqrt{2\,gh}}{F},$$

wherein F is a factor of safety, w the weight of ram, g the acceleration of gravity and h the fall of the ram in feet at the last blow.

Substituting the value of g, taken as 32, and assuming a factor of safety of 4½, for an average case, this reduces to

$$\text{Safe load} = \frac{8\,w\,\sqrt{h}}{1.125},$$

which is the final form given by the author.

It will at once be apparent that a limitation of application is required because, as it stands, it would manifestly give equal results of a given blow for all penetrations.

The author limits it to a depression, or last blow penetration, of ½ in. or less; for any greater depression an adjustment would be necessary to bring about consistent results; he does not, however, provide for any such adjustment in the formula, which incompleteness would exclude it in many cases not to be avoided in ordinary practice. This omission is the more remarkable because the author expressly, and correctly, states that the resistance a pile offers to the blow of the ram is the measure of its capacity to sustain a stress and that "all other elements, except that of penetration, are rendered of no consideration, as elements of the computation of effect."

As a preamble Mr. Haswell points out the wide discrepancies in existing formulas; in doing so he is by no means the first, Mr. Rudolph Hering in his monograph on Bearing Piles, published in 1887, having tabulated no fewer than fourteen discordant recognized formulas; and later Mr. Foster Crowell, in an elaborate paper on the subject* before the American Society of Civil Engineers, went very completely over the ground, analyzing and comparing the results from sixteen formulas, comprising all of high authority, in the endeavor to select one that should be at once reliable and simple, the keynote of his discussion being that "it is neither worth while nor sensible to waste time in refining a result beyond the degree of refinement of the available data, which are the weight (w), the fall (h) of the ram and the penetration under the last blow (s)." The particular formula which he selected as the best, all things considered, was the well-known Wellington form, which will be again referred to.

*Transactions Am. Soc. C. E., Vol. XXVII.

Mr. Haswell contents himself (as well he may) with comparing only ten formulas, but in that number includes two that were omitted by both Crowell and Hering.

His list comprises the familiar Trautwine, Sanders, Rankine, Weisbach, Nystrom and Wellington formulas, besides those of McAlpine, Molesworth, Mason and the "Dutch." In his treatment of the subject, as before remarked, a pile is considered as in all cases driven to a final depression (penetration under last blow) of ½ in. or less, which fact is to be borne in mind in reading his formula; he assumes two cases, which respectively are (a) a 1,000 lb. ram falling 20 ft. and (b) a 2,000 lb. ram falling 25 ft., and after recapitulating the widely varying values from eight of the above formulas (rejecting the other two as utterly unworthy), sums up as follows:

"The average of results for safe loads, deduced by the several formulas given are, for a ram of 1,000 lbs. falling 20 ft., 40,901 lbs., a result 2.04 times greater than that given by the formula of an author of the highest recognized ability (whom the table shows to be Rankine) and 1.46 times less than by another author of similar standing (Molesworth and Sanders seem to divide this honor), while for a ram of 2,000 lbs. falling 25 ft. the average is 87,271 lbs., a result 2.182 times greater than that given by the first author referred to, and 1.35 less than that given by the other. The Weisbach and the "Dutch" formulas were not included in the preceding recapitulation, as the factors in the first are held to be too extreme for practical application, and the introduction in the other of the average penetration per blow per 100 blows of the ram is not an element of any value, for, as before stated, the final blow of the ram is the only one that measures its effective value."

Mr. Haswell next examines some records of ascertained weights on piles and in four cases compares the observed results with those that would be given by a hypothetical formula, $L = w\sqrt{2gh}$ (i. e., the product of the weight of the ram multiplied by its velocity), and finds that the sustaining powers are greater, in the respective ratios of 3.33, 2.93, 2.88 and 3.65; which four cases give an average of 3.2.

He then proceeds to say: "In view of the variances noted the author essayed to ascertain the difference between the results by the formulas or foot pounds, and the actual vis viva of a falling body; and although the experiments were necessarily on a very limited scale the following results were obtained:

Weight, pounds.	Fall, feet.	Velocity, feet.	Impact, pounds.	Ratio of impact to velocity.
1	1	8	32	4.0
1	1.5	9.8	42	4.3
1	2	11.31	52	4.6

"Reviewing these and the various other elements submitted, it appears that all the formulas here illustrated, for piles driven under the usual requirements of practice, as to weight of ram, height of fall, character of soil and final depression are but arbitrary, with factors of safety having the wide range of three-tenths to one-twelfth. They present even the varied conditions of the weight multiplied by its height, by its square, and also by its cube, while that of Wellington presents the exceptional condition of the weight being multiplied by twice the height of the fall; all of them being at variance with the accepted rule, that the velocity of the weight and its resultant impact (sic) is as $\sqrt{2gh}$. Further, that the impact or vis viva (sic) of a body falling freely, as determined by the experiments here referred to, exceeds four times that given by the formula for its final velocity, which result is verified by the illustrations given of the actual sustaining power of the piles above noted, to which should be added an estimate of the frictional losses of the ram in operation."

"Reviewing the elements presented, the following formula is presented (as already given above),

$$\text{Safe load} = \frac{4\,w\,\sqrt{2\,gh}}{F},"$$

So far we have quoted the author verbatim in order that no injustice might creep in through a different use of scientific terms from that which he has employed.

That use, however, invites inquiry, as well as criticism. When, for instance, he speaks of "impact or vis viva of a body falling freely," as if they were one and the same thing, and again of "the accepted rule that the velocity of the weight and its resultant impact is as $\sqrt{2gh}$", as affording a comprehensive principle affecting the driving of the pile which has hitherto been overlooked by all the investigators.

Of course there can be no such thing as impact of a body falling freely, for it is only when its motion is opposed that impact results. Impact and vis viva are totally different things. What en-

ables the descending weight to drive the pile is the energy stored therein; but not all of it is available for the purpose; that which is available is known as the "accumulated work," and is equal to one-half the vis viva, $= \frac{1}{2}Mv^2 = \frac{wv^2}{2g}; = \frac{w\ 2gh}{2g} = wh$, the velocity of a moving body is a manifestation of the work accumulated in the body, but is not its measure; these, of course, are elementary truths, but it is well to have them in mind and especially to remember that under no circumstances can a body falling freely impart more than half the vis viva due to its fall, which is always equal to the simple product of its weight multiplied by the distance through which it has fallen. That effect may be expressed in foot-pounds or inch-pounds or half-inch-pounds, or any other combination of weight and fall, but it never by any possibility can exceed itself. It would be most surprising if all the great investigators who have busied themselves with the problem of the pile formula had overlooked the question of velocity; as a matter of fact they have not, as anyone can see by following through the usual demonstrations in the text-books.

Moseley says that it is evident that the pile will not begin to be driven until a period of the impact is attained, when the pressure of the ram upon its head, together with the weight of the pile, exceeds the resistance opposed to its motion by the coherence and friction of the mass into which it is driven. After the pile has moved through any given distance, one portion of the work accumulated in the ram before its impact will have been expended in overcoming, through that distance, the resistance opposed to the motion of the pile; another portion will have been expended upon the compression of the surfaces of the ram and pile; and the remainder will be accumulated in the masses of the ram and pile, moving at a reduced velocity; under ordinary circumstances the ram will still have a portion of the accumulated work in it when the pile ceases to move; this amount, together with that which must have been done to produce that compression which the surfaces of contact retain at that instant, will in no respect have contributed to the driving of the pile, will have been expended uselessly.†

He also says: "Vis viva does not represent a pressure, or force, but the numerical equivalent of the product of a certain number of units of pressure and a certain number of units of path. The one magnitude being of as totally a distinct order from the other as an area is different from a line, and therefore having no common unit of measure."‡

Computing the several values of the vis viva of the falling weight in the above table we find them to be 2, 3 and 4, respectively, instead of 32 lbs., 42 lbs. and 52 lbs., as given for the values of "impact."

The author does not describe the experiments, so that we are left somewhat in the dark as to the meaning of the term "impact" as he has used it. By it he very probably means the resistance to the falling weights as determined by some weighing apparatus. But without knowing the distance traversed by the falling weight during retardation we can form no concept of the significance of the values. Whatever may be the weight of the impinging body or the velocity of the impact, there is in every case a finite amount of work yielded upon the opposing resistances; there is in every such case a certain mean resistance, R, overcome through a certain space, S, in the direction in which the resistance acts, which resistance and space are such that

$$RS = U, \text{ and therefore } R = \frac{U}{S}$$

If, therefore, the space, S, be exceedingly small as compared with U, there will be an exceedingly great resistance, R, overcome through that small space, and vice versa. Taking as the values of R the impacts as given in the table, we find that the corresponding values of S, in inches, are respectively .375, .410 and .461, representing lost motion or friction, or both, in the weighing apparatus.

If the apparatus had been heavier in its parts and more sensitive, the recorded "impacts" might, and probably would, have been much higher.

To turn to the author's claim for superiority of his formula over the others, a comparison with one only will be made, that of Wellington, which is

$$\text{Safe load} = \frac{2\ wh}{s+1}$$

wherein w is weight of ram, h its fall in feet, and s the depression, in inches (not in feet, as stated by Mr. Haswell) under the final blow. The quantity 1 in the denominator is a constant introduced to allow for effects of friction in the pile driver and other interfering causes tending to reduce the force of the blow. This formula is based upon the principle of accumulated work expressed in inch-pounds, but containing a silent factor of safety of 6; otherwise it would be written

$$\text{Safe load} = \frac{12\ wh}{F\ (s+1)}$$

It will perhaps surprise Mr. Haswell to have the fact pointed out that for the same (any) factor of safety his formula and Wellington's give identical results of a 16-ft. fall and ½ in. penetration. For greater falls than this the Wellington formula gives greater values than the Haswell, and for lower falls, lower values. In the two cases employed by Mr. Haswell for comparison, his formula would give 23,840 lbs. and 53,333 lbs., and Wellington's, 26,666 lbs. and 66,666 lbs., using in both the Wellington factor of safety, 6; but using the proposed Haswell factor, 4½, the latter's results are 31,800 lbs. and 71,000 lbs.; that is to say that on equal terms the Wellington formula gives higher values but taking each formula as stated by its author the Wellington gives somewhat lower values than the Haswell, in these two cases.

One other statement in the paper seems unwarranted by the facts educed in its support, viz., that the result of the experiments with the falling weight is verified by the illustrations given by the actual support of piles noted. These are only five in number. Case I. At the London Bridge piers the piles are reported to sustain 80 tons each; no data of the weight or fall of ram are attainable, but Mr. Haswell assumes them to have been 1,500 lbs. and 20 ft., and finds that 80 tons is 3.33 times that of the hypothetical formula. Either the fall or the weight may of course have been considerably greater; furthermore Trautwine, from whom the case is taken, mentions that very serious settlements, amounting to a foot or more, had occurred under these piers.

Cases II. and IV. are of piles driven with only 5 ft. fall, and very light ram in one case; they are not conclusive, but so far as they go they give ratios of 2.93 and 3.65 to 1 over the hypothetical formula.

Case III. is somewhat clearer: here a pile driven by a 1,700 lb. ram, falling 16 ft., supported 70 tons, and gave a ratio of 2.88 to 1. The average of the four ratios is 3.2 to 1, whereas the average of the results which Mr. Haswell claims they verify is 4.3 to 1.

Finally Mr. Haswell gives one case of piles driven to sustain the vibratory stress of a railroad bridge, under a ram of 1,200 lbs., falling 20 ft., with a penetration of 0.75 in., that enduringly sustained 18 tons each, and by his formula the result is 17 tons.

His formula, it is true, would give this result with a factor of safety of 4.5 and a penetration of 0.5 in. (although if account were taken of the greater actual penetration it would not), but to corroborate the formula the actual sustaining power of the pile should show a much wider margin of safety.

There is no doubt that in favorable situations where small penetrations, not exceeding ½ in. under average weight and fall of ram, can be obtained, Mr. Haswell's formula will give conservative, though not always the most economical results. The same thing can be said of several of the formulas which he criticises. It is not in such situations, however, that a reliable and economical formula is most needed, but in the far more numerous cases where the penetrations are excessive and the bottom weak and where the engineer must load fully but not overload either the piles or the stratum in which they are driven.

In all such cases a formula based on the penetration of the piles is essential. Mr. Haswell's is thus not adaptable to prevailing conditions, while the Wellington formula is.

Mr. Haswell gives the friction of compressed sand on the surface of a pile at 614 lbs. per square foot. This is too high a value to be ordinarily met with. Experiments recently made by U. S. Government Engineers at New Orleans for an emplacement foundation with eight test-piles ranging from 16 to 28 ft. long, driven in a mixture of sand and hard clay and through a very much compressed sand stratum, gave an average result of 438 lbs. per square foot, the lowest being 398 lbs. But it was afterwards found that a portion of the foundation loaded with only 85 per cent. of the test-pile indications settled from one to two feet very unevenly, while another portion settled six inches with only 37 per cent. of the load; presumably the whole stratum was overloaded.§

Mr. Haswell gives useful advice regarding the distance apart at which piles should be driven, which he says should be increased in saturated sand and earth, or in silt, as small piles are liable to be disturbed in their positions by the driving of large ones adjoining them, and he might have added that the ground is often heaved and displaced from the too close proximity of piles or driving them in rows contiguously instead of intermediately at first. He also says that sometimes it is proper to reduce the result obtained by formula, to meet incidental conditions, such as negligence in driving, or in superintendence, the frequent and unobserved splitting or crushing of a pile on a hidden stone or boulder, etc., etc. C. E.

†Moseley's Mechanics of Engineering, p. 564.
‡Ibid, p. 589

§Report of Chief of Engineers, 1898.

Pneumatic Riveting.

The remarkable growth of the portable pneumatic tool business has led to the conclusion that these small machines must have important advantages, either in the greater ease and rapidity of doing work or because the cost of work can be materially lessened by their use. Probably all of these things have been credited in a general way to thse tools, and have had an important effect on their introduction. Hence, the experience of the Chicago Ship Building Company with portable pneumatic riveters, as just given in a paper by Mr. W. I. Babcock before the Institution of Naval Architects, London, will be received rather as evidence confirming this opinion, although it is the best information on this subject that we have seen. Last November, Mr. Babcock wrote a brief paper on riveting machines for the New York meeting of the Society of Naval Architects and Marine Engineers, but the later paper is far more complete.

Three years ago the Chicago Ship Building Company began experiments to develope portable riveting machinery to be operated by unskilled labor, and with which all the rivets in a ship could be driven; we are told that this has now been done. Much trouble was had with the hand riveters who are described as "extremely independent, arrogant and high-handed in their relations with the company, giving more trouble than all the other classes of labor in the yard put together." The riveting is said to be about the hardest manual labor connected with ship building, and the necessary skill is only acquired after a long apprenticeship at the trade and varying with the class of rivets driven. That is, a first class shell riveter cannot properly drive inside rivets, and a man trained on boiler riveting is of little use on any part of the ship's hull. The work is done in the open air, exposed to the weather and the men wear out while still young. Wages are necessarily high, and most of the work is done by the piece, so, when work is to be had, the hand riveter makes a great deal of money at the expense of his vital energies, which he is too apt to attempt to restore by drink. All his tools are furnished, and as the work is much the same in all ship yards, there is little incentive to own anything or to remain long in one place. Beside getting rid of such troublesome workmen the riveting machines permit larger and longer rivets to be used than could be closed down by hand. On a recent ship 250,000 rivets were driven by compressed air hammers out of a total of 340,000, and the proportion would have been greater but for an insufficient air supply.

These machines consist of a pneumatic hammer and a pneumatic holder-on, mounted on a frame or yoke, although a few special forms of mounting are required for special work. Of the yoke riveters those with a 9-in. gap weigh 83 lbs., the 51½-in. ones 160 lbs., and those with a 70-in. opening weigh 220 lbs. These compressed air riveting machines are considered more suitable than other forms, being lighter and better adapted for use in close places, although they were selected only after other kinds had been tried. The severe winter climate in Chicago is unfavorable to the use of hydraulic compression riveters out-of-doors, the weight is excessive, and they had never made much headway in British ship yards, although long on the market. Electrical machinery is considered costly and delicate, and not well suited to the conditions. Also, a short experience with compression riveters driven by air showed that because of their great bulk and weight (over 2,500 lbs. for a 6-ft. opening), they could not be handled so as to make them useful or economical. It was also deemed well to use compressed air for the riveting machines, as a compressing plant was necessary in any event to supply the pneumatic chipping and caulking hammers and the drills and reamers, as well as to ventilate and cool confined places.

As to the quality of the riveting done by the pneumatic hammers, Mr. Babcock states that this is "first class in every respect, and far superior to hand work, and such is the unanimous opinion of the inspectors who have been and are on duty in our yard." This point has been the subject of a good many discussions. Further, it is said, that with the pneumatic hammers the rivets are closed down more rapidly, and at a much higher temperature; that, as it is easy to bring the hammer in line with the axis of the rivet, the rivet is plugged by the first blows, filling the hole throughout before the point begins to form. In confined places where hand rivets are apt to be poorly driven the pneumatic hammer is of great advantage, for if the rivet can be reached at all, it is as well driven as in the most open parts of the work.

The following figures of cost from a ship recently built are submitted, which it should be noted do not include the cost of air, repairs, interest, etc., but are merely the labor charges:

Inside Rivets. All ¾ in.	Number.		Cents.
Hand, piece-work	25,073	Average cost	3.16
" day-work	9,255	" "	8.57
Air	151,167	" "	2.06
Steam	23,544	" "	0.51
Shell Rivets. ⅞ in. and 1 in.	**Number.**		**Cents.**
Hand, piece-work	51,306	Average cost	3.99
" day-work	4,314	" "	7.69
Air	74,493	" "	2.96

It is not known just how much should be added to the pneumatic riveting to cover interest, maintenance and the cost of compressing the air, as many other pneumatic tools were in use at the time the riveting was being done. During much of the time, also, the full air pressure could not be maintained, due to insufficient compressor capacity, which seriously impaired the efficiency of the hammers. Then the development of the riveting machines as well as breaking in the men took place while this ship was building, which affected the cost, especially as the men were not riveters or mechanics, but merely common laborers. Because of these things the com-

parison of costs is probably not very fair. The steam riveter was stationary and was used only for such portions of the work as could be assembled and handled as a whole.

The largest rivets so far driven with these hammers are 1 in. in diameter, but there are no reasons why larger sizes cannot be driven with satisfactory results by using a hammer of longer stroke. In fact, in other places 1¼ in. rivets have been so driven. It is also thought that in a short time the methods for doing this kind of work will be so improved that the efficiency and economy of the tools will be greatly increased.

The Dayton Draft Rigging.

The accompanying engraving shows three different applications of a new draft rigging designed and patented by Mr. Edward Grafstrom, Chief Draughtsman, of the Pennsylvania Lines West of Pittsburgh, which is being put on the market by the Dayton Malleable Iron Co., Dayton, O. Those who attended the Old Point Comfort Conventions will remember a full-size model of this rigging was among the exhibits. The advantages claimed are the small number of parts, no bolts are used and the principles embodied in the design are applicable to a wide range of conditions. In addition to the tandem, double-spring and single-spring arrangements for wooden draft sills, as shown, designs are now being made for similar arrangements for use with car or tender draft sills made of malleable iron or rolled steel. Tests and service trials go to show that this new draft gear is at least as strong as the best rigging now in common use, and is singularly free from broken draft springs.

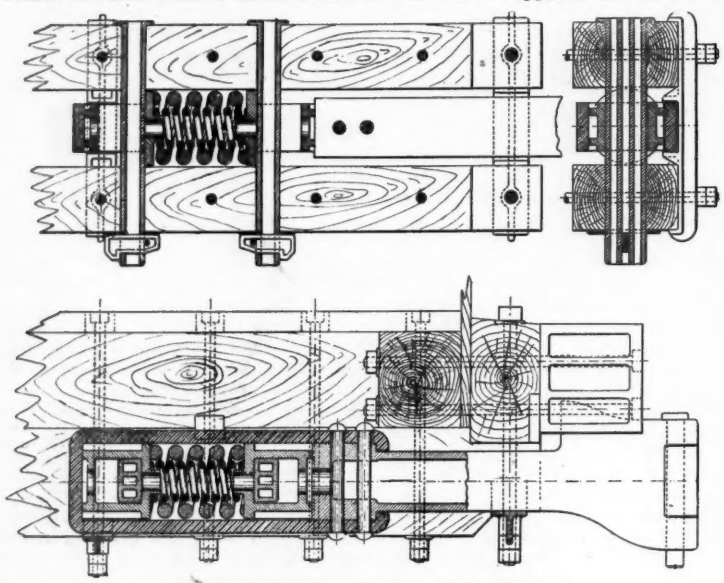


Fig. 1.—Dayton Draft Rigging with Single Spring.

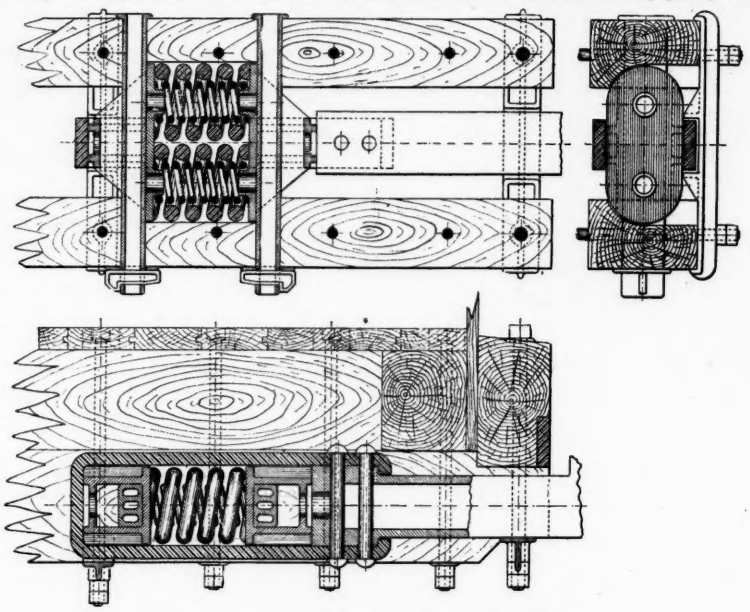


Fig. 4.—Dayton Draft Rigging with Double Springs.

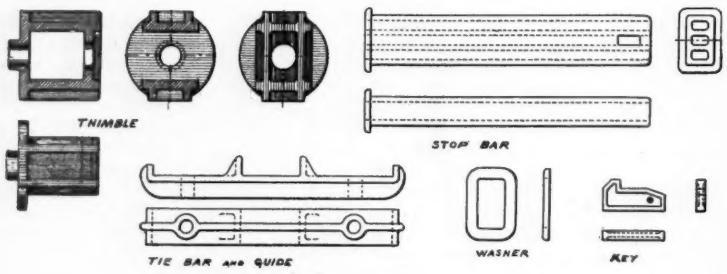


Fig. 2.—Details of the Single-Spring Dayton Draft Rigging.

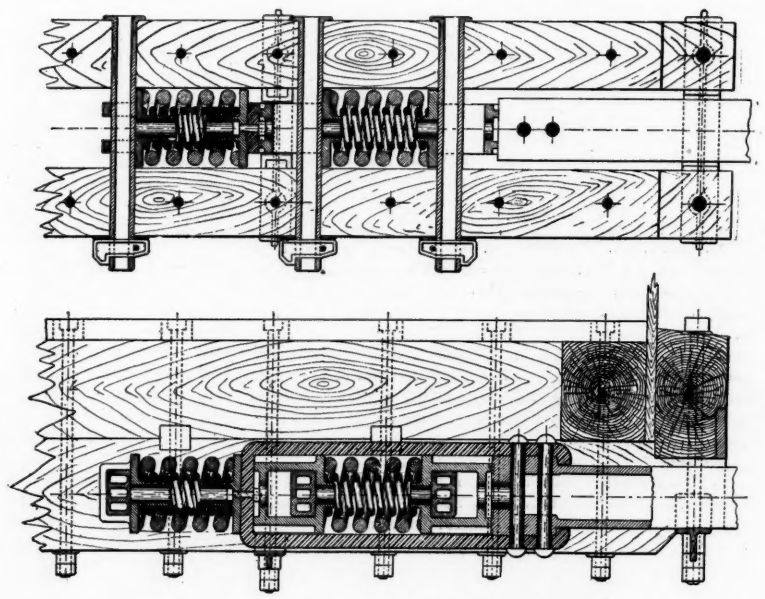


Fig 3 —Dayton Draft Rigging with Tandem Springs.

Figs. 1 and 2 are the single-spring arrangement and the detail parts, all of which are of malleable iron, and these engravings show quite clearly the essential features of the rigging. A thimble is placed within the coupler yoke at either end of the spring, and stop bars pass through these thimbles and the draft sills, taking the place of the usual follower plates, besides supporting the rear end of the coupler and holding the sills together; at the front the coupler is supported by a malleable iron tie bar and guide. It will be seen that with this arrangement the draft rigging for a car consists of the following parts: Two yokes, four thimbles, four stop bars, four washers, four keys, four cotters and two tie bars, making in all 24 parts as against 220 pieces required by the present M. C. B. recommended practice. It is stated that with the Dayton rigging a coupler can be removed and a new one applied in five minutes.

The proportions of the thimble and stop bars are made such that the springs are not closed solid when the coupler has reached the point of maximum travel. The compression of the draft spring is 2⅛ in., while the travel of the coupler under either pulling or buffing forces is limited by the thimbles to 1⅞ in. The buffing forces are taken by the rear stop bar until the coupler has moved a distance of 1⅞ in., when the forward thimble comes solid against the forward stop bar and additional loads are distributed between the two bars. The capacity of the single-spring is 19,000 lbs., and as many locomotives have tractive powers greatly in excess of this, the stop bars are each made to withstand the full tractive effort of the heaviest locomotive. The amount of material removed from the sills for the insertion of the stop bars is said to be less than that cut out for a number of riggings now in common use.

With reference to Fig. 3, the tandem arrangement, it may be noted that the second spring is only of use in resisting buffing forces, but by extending the coupler yoke it could be made of use for buffing and pulling, the same as the double-spring arrangement shown by Fig. 4. The tandem arrangement has 31 parts and the double-spring rigging 24 parts.

In 1896 this draft rigging was first applied to a small number of cars, to one of which was given a severe test. This car had draft sills 4½ in. wide, and these were reduced to 3½ in. alongside the springs. The test consisted first of a jerking test in which two box cars were coupled together with a switch rope, one of the cars having the new single-spring draft rigging and the other the Graham. Both cars were equipped with the M. C. B. couplers, and the switch rope was secured to the knuckle of each. The cars were placed between two locomotives, facing in opposite directions, and at a given signal the engines were started forward, bringing up the slack in the switch rope with a sharp jerk, sufficient to shear off the pivot pin of one coupler and to break the knuckle of the other. Neither rigging was damaged in any way. The same cars were afterwards submitted to a series of kicking tests. They were placed about two hundred yards apart and kicked towards each other at a speed which in the final test equalled 15 miles an hour. The cars were loaded with iron scrap, and when they came together the lading forced out the end of the car with the new draft rigging, while on the one with the Graham the two center sills were broken. Neither draft rigging was injured in the least. These tests were considered to show that the new rigging was at least as strong as the Graham. Similar tests of the tandem-spring arrangement are to be made shortly.

Since 1896, what has become known as the Dayton rigging has been applied to something over two hundred cars as well as to a number of locomotive tenders, and when examined recently all of these were found in good order and no repairs have been needed during that time. Later we expect to show some of the designs where metal draft sills are used.

Teaching Engineering.

The following remarks are selected from a discussion by Prof. D. C. Jackson (University of Wisconsin) of the paper on Methods of Teaching Engineering, read by Prof. C. Frank Allen of Mass. Inst. of Tech., before the Society for the Promotion of Engineering Education:

Such men as Faraday were the early great engineers, and their far-sightedness is illustrated in the present consummation of that remark of Joule, "I can scarcely doubt that electromagnetism will eventually be substituted for steam in propelling machinery." What proportion of the college bred engineer apprentices of this day are inoculated with the same broad spirit of far-sightedness we cannot tell, but I fear the proportion would grieve us were it known. The force of our college training is often broken by too much bending toward the applicability of the methods of teaching and the subjects taught to the immediate earning of dollars by the graduates while the effect upon their later development into men of power is forgotten.

The abstract of Professor Allen's paper shows so just an appreciation of various requirements in engineering college courses, that I overcome a hesitancy to enter into a discussion where there may justly be many conflicting opinions. To my mind, an information course, so-called, must be superficial and so be injurious to a college student. "It is not book-learning young men need, nor instruction about this or that," so much as, "a stiffening of the vertebræ which will cause them to be loyal to a trust, to act promptly, concentrate their energies, do the thing required," and do it of their own initiative, using their own powers of thought. The student must be inspired and taught to work for himself in the manner used by George Stephenson when instructing his assistants and pupils. "Learn for yourselves," said he, "think for yourselves, make yourselves masters of principle, persevere, be industrious, and there is then no fear of your success." To my mind the cri-

terion of success of a college course in engineering which is frequently applied especially in the West,—that is, a judgment based upon the rate of pay received by the men immediately upon leaving college,—is entirely erroneous, though the criterion seems to be endorsed at some of our schools of engineering.

Four years is but a small part of Faraday's period required "to make a man" in the physical sciences, and in so short a period only the foundations for our man can be laid. The college course in engineering should be bent toward such a complete and true presentation of thorough science and truth that the student is incited to permanently secure it for himself and make it fully his own, and it may then be put to valuable use in future practice. I should gladly be judged of the success of my teaching by the success attained by my students after years of practice, but let no judgment be passed upon the basis of wages received during the year after graduation.

The engineering course should not be too formal or limited to the didatic methods used of old in the instruction in classics. Professor Tait speaks the views of the scientist when he says: "It is better to have a rough climb (even cutting one's steps here and there) than to ascend the dreary monotony of a marble staircase or a well-made ladder. Royal roads to knowledge reach only the particular locality aimed at—and there are no views by the way. It is not on them that pioneers are trained for the exploration of unknown regions."

To the engineering student in college, the laboratory is of inestimable value. In it he can learn the true relations between science pure and science applied. He can learn to reason true from cause to effect. His mind can be developed less trammeled than in the class room, and the inspiration to independent thought may be more readily given deep root. "Every branch of engineering is becoming rooted more firmly to the scientific bedrock upon which it rests," and the engineer must be a man of scientific instincts, scientific thought, and scientific methods, besides being a man of business. He must have learned with the scientist that the price of success is constant, concentrated effort. All this can be taught better in the laboratory than in the class room. Said Mr. Hart in the Atlantic Monthly not long since, "Genius is nine parts character. The prize is to him who dares, not merely to him who can." In the laboratory the student may be inspired to dare.

I would have at least one-half of the time consumed by students in the study of applied science or engineering spent in properly supervised laboratories. The work in the laboratories should be strictly of a scientific character.

In this nation the industrial pursuits are engineering pursuits and in the present juncture,—after the laws of mechanics,—the laws of electricity seem to be of the most importance to the industrial engineer. I would therefore give great weight and strength to the electrical laboratories. While the subjects particularly taught are not of so much importance as the effect upon the student's powers—("Victory is for the people who see things as they are without illusion,—who do not take phrases for facts,")—the well-planned laboratory courses in applied electricity serve excellently to give that clear sight of "things as they are" which is essential to success.

Caskey Portable Hydro-Pneumatic Riveter.

The engraving shows a sectional view of a new style portable riveter, manufactured by Pedrick & Ayer, Philadelphia, adapted for shipyards and structural iron works, and the use of boiler makers and bridge builders.

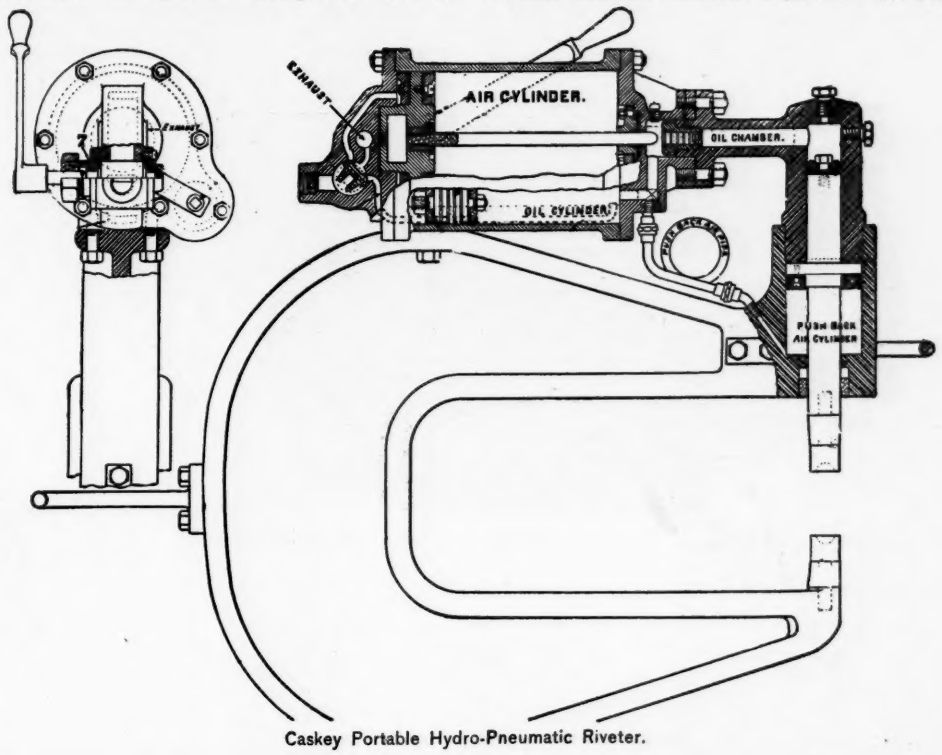
The Caskey portable hydro-pneumatic riveter is designed for using compressed air as a prime mover, with the hydro-carbon fluid used in the oil chambers and oil cylinders. This admits of the machine being run in very cold weather and in open places with no liability to freezing.

The engraving is largely self-explanatory. The main frame is a steel casting, and can be made in any desired shape. The oil chamber and pressure cylinder is made of nickel-steel forging and accurately machined. The dolly bar or hydraulic piston, 13, is of tool steel. The inside cylinder head is of cast steel.

There are but four moving parts, and the operating lever is the only moving part exposed. The riveter works rapidly, without shock or jar, is easy to handle and gives a uniform pressure on every rivet. No blow is given when using this machine.

The riveter is suspended by a bale, which allows it to be moved and operated in either a vertical or horizontal position; by changing the bale it can be used sideways with equal facility. The operator can control all movements of the riveter whether standing at the side, back or front of the machine.

No adjustment of the length of the dolly bar, or the rivet dies is required when riveting on various thicknesses of metal. The dolly bar has a movement of 4½". The first 2¼" is the rapid movement, which is direct by the pressure from the receiver tank of 80 pounds. The last 2¼" is called the effective movement and develops the maximum pressure, giving a uniform squeeze throughout the entire stroke of the last 2¼", which causes the hot rivet to fill the hole solid. This pressure is exerted on the dolly bar through the hydro-carbon fluid, and so long as the operating valve is open, admitting compressed air to the main piston, the maximum squeeze is maintained on the rivet. After a rivet is headed, the dolly bar and the die are positively moved back from it by a movement of the operating lever. The Caskey riveter is built in twenty-one different styles and sizes, for driving rivets from ⅜" to 1¼". All machines are proportioned for using compressed air at 80 pounds per square inch, and to exert whatever pressure on rivets is required. Messrs. Manning, Maxwell & Moore, New York, are the sole sales agents.



Caskey Portable Hydro-Pneumatic Riveter.

American Locomotives on British Railroads.

In the Engineering Magazine for September Mr. Charles Rous-Marten gives a few notes about the status and prospects of American locomotives on the British railroads. We quote a few sentences, giving something of his own opinion, and, so far as he could gather it, the opinion of Mr. Johnson, of the Midland, and Mr. Ivatt, of the Great Northern. Naturally and properly, however, these gentlemen suspend judgment, or at least the expression of judgment.

"A few days ago I visited Derby for the purpose of examining the engines constructed at the Baldwin works for the Midland company, of which a number had been placed on some short sidings outside the works and were in course of erection by the representative of Messrs. Burnham, Williams & Co., and his assistants. Much difficulty has been experienced in obtaining a sufficient supply of skilled labor, owing to the large demand for it at the present time; the Midland company is bound only to provide unskilled labor for the erection. Consequently the progress has been slow and so far only one of the engines has been tried in steam. Unfortunately, this pioneer was immediately disabled by a slight accidental collision and has had to go in for repairs. Therefore so far not a particle of information can be given as to results.

"I could not help noticing the rougher external condition of some of the castings as compared with those in the Derby-built engines, in the parts where extreme finish was not required for practical purposes. But I could not see that the engines suffered any loss of usefulness through the external roughness of such a part as, for instance, the valve-chest, which, moreover, was not exposed to view owing to its casing. Mr. S. W. Johnson, the eminent mechanical engineer-in-chief of the Midland line, who courteously accompanied me on my inspection, appeared to concur in this view, although he declared very explicitly his determination not to form or express any opinion upon the merits of the engines until these should have been ascertaind by actual trial.

"When I remarked on the absence of the fluted connecting-rod and side-rods which have become so common in American practice and, indeed, in British practice, also, Mr. Johnson explained that personally he preferred plain rods as giving more elasticity in rounding curves, the fluted rods being, in his opinion, although doubtless stronget, yet too rigid and unyielding, while on the other hand he did not find the plain rods, although more elastic, addicted to bending or breaking.

"At Doncaster I found Mr. H. A. Ivatt, the chief mechanical engineer of the Great Northern Railway, equally reticent as to his opinion upon the relative merits of the American and British methods. He mentioned that, in the engines under construction in the United States for the Great Northern main line, he had caused the sand-box to be placed below the frame instead of being on the top of the boiler as is usual in American practice. This will remove another of the differences in outside appearance. This is a more important point than it may seem at first sight to be, for railway directors do not like to offend the prejudices of their customers, the British public, by any needlessly obtrusive display of 'foreignism' about their locomotives or rolling stock. Thus, if the American-built engines can be turned out so similar in outside aspect to the British-built article that only the eye of an expert can detect the difference off-hand, and if these engines can be supplied more promptly and more cheaply than the home product, it needs little of the spirit of prophecy to foresee that keen American competition in locomotive supply is one of the conditions with which British engineering firms will have to reckon very seriously in the near future.

"From my own experience of American engines in the British colonies, I entertain no doubt of their proving entirely satisfactory in the mother country. I anticipate that they will be found peculiarly easy on the permanent way, owing to the good services of the faithful 'track-feeler,' the pony-truck. A veteran British engineer, Mr. David Joy, the inventor of the famous valve-gear which bears his name, was conversing with me to-day on the subject, and he expressed that opinion very strongly, but he doubted whether the American locomotives might not be 'heavier on repairs' than the British. This, however, has yet to be seen."

Some Improvements on the C. & O.

In the annual report of the Chesapeake & Ohio we find the following interesting statements:

Early in the calendar year your Directors thought it wise to provide for the prosperous times which they thought were coming by building certain additions to the plant of the company which had been delayed for some years waiting better times. In the first place, at Newport News they decided to erect a new grain elevator, an ocean pier and a coaling pier, at a cost of about $500,000. This addition will add largely to the capacity of the company; will also aid in the economical working of the plant and will be a great protection in case of fire, as it practically duplicates the tidewater facilities of the company—the new plant being at such a distance from the old plant as renders unlikely its destruction by a fire which might destroy the other.

The company has also desired for some years to build an elevated structure through the city of Richmond, together with a passenger station, thus adding to the facilities of the company and avoiding many street crossings and difficult grades. It was fortunate in securing from the city of Richmond valuable concessions and also in closing the contract for the iron structure before the large increase in price which has since taken place. This improvement, when completed, is estimated to cost about $1,500,000, and the saving in expense of operating will be fully equal to the annual charge upon the bonds issued for the cost of this improvement, to say nothing of the greatly needed enlargement of facilities thereby afforded.

The company is also engaged in the construction of a line of 13 miles along and across the New River and up Piney Creek in West Virginia, to develop additional coal territory naturally tributary to this company.

It has also decided to build various sections of double track over the mountains and through the coal districts, aggregating about 30 miles, which will practically make a double track of the line from Richmond to the New River coal district, the company having two lines from Richmond to Clifton Forge. The addition of these 30 miles of double track to the 98 already constructed increase the facilities for doing business upon the most crowded part of the line.

The Imperial Steel Works of Japan.

The iron and steel plant which the Government of Japan is now building is situated at Kiushiu, about ten miles from Moji, near Wakamatsu. The works face a bay called Dokai. It is intended to dredge out this bay, so that there will be a fairway to the wharf now building at the works, by which vessels of about 3,000 tons burden may reach the wharves and discharge iron ore. The ore will have to be brought either from the Yangtsze, in China, or from the Kamaishi mines, in the north of Japan. There is an abundance of coal within a radius of 100 miles from the works. The ore will be carried from the wharf by electric cranes to the rear of the works, where the ore bins are placed. These bins are designed to hold ore enough to keep two blast furnaces going for two months.

The blast furnaces will have a capacity of 350 tons of ore each in 24 hours, and each is calculated to produce 165 tons of pig iron in this time. The blast and roasting furnaces are well supplied with electric hoists. In fact all over the works as many labor-saving appliances as possible have been adopted. The system is American, though the plant has all to be made in Germany. The molten metal from the furnaces will generally be transferred direct to the mixers, which are of 160 tons capacity.

The engraving shows a sectional view of a new steel converters and four 25-ton Siemens-Martin furnaces. The total annual capacity of the works is 90,000 tons—that is, 45,000 tons each of Bessemer and open-hearth steel, for which 120,000 tons of pig iron will be required.

It is proposed to roll rails of all sections and sizes, plates up to 2 inches thick and 7 feet wide, rounds, squares, and angles of all sizes, and joists up to 12 inches high. With the exception of that for the locomotives the steam generated for driving all of the machinery will be heated by the waste gases from the different furnaces.—Bulletin of the Iron and Steel Association.

Manufacturing in the South.

The annual report of the Southern Railway gives the following particulars of the textile and industrial development along its lines: Five cotton mills, having an aggregate of 43,612 spindles and 1,172 looms, together with two knitting mills, having 33 knitting machines, have been completed on the line during the year. There are now in process of construction on our line 18 cotton mills, aggregating 515,412 spindles and 1,980 looms, estimated value of the plants being $5,716,000. In addition to the above, established plants on the line have added 224,802 spindles, 4,224 looms, and 55 knitting machines, representing an outlay of $4,757,350.

Besides the large increase in textile industries, there have been located on the line many wagon factories, furniture factories, flour mills, farming implement manufacturies, cotton seed oil mills, ice factories, brick and tile works, glass works, canning factories, tanneries, electric power plants, saw mills, broom and mattress factories, barrel factories, spoke works, etc., which is most gratifying. As to ore and coal mining, blast furnaces, and iron and steel works, the prospects in and around Bristol, Embreeville, Knoxville, and Chattanooga, Tenn., Middlesborough, Ky., and Birmingham and Anniston, Ala., are most encouraging.

The Work of a Testing Department.

The remarks of Vice-President Gannon, in the annual report of the Southern Railway, include the following comment on the Testing Department:

The work of this department has been continued and expanded during the year with beneficial results. In addition to the usual inspection of supplies for the roadway and motive power departments, all of the more important material entering into the purchase of new bridges and new equipment has been inspected. The material for 31 new steel bridges and viaducts, aggregating 6,056,063 lbs., has been inspected and tested, and the assembling at the manufacturers' shops of each of these bridges, in order to see that the fitting, riveting and workmanship generally, was of the best, has been supervised. Imperfections in material and workmanship were thus detected and corrected before the bridges were shipped by the manufacturers. The manufacturers of supplies have become so familiar with the system of inspection that the ratio of material rejected has materially decreased, averaging now only about three per cent.

Miscellaneous work performed by this department during the year has consisted of the examination of paints, oils, waste, etc.; analyses and examinations of waters with respect to suitability for boiler use, as well as occasional analyses of water for drinking purposes, and examination of various coals with respect to their fuel value. Examinations and analyses have also been extended to samples of ores, clay, and other natural products (deposits of which are found along the line of road), for use of the land and industrial department.

Attention has been continued with respect to replacing high priced proprietary articles with equally efficient articles which we ourselves can produce more economically, such as grease for air-brake cylinders, dye for plush of car seats, and an emulsion for car-cleaning purposes.

The Vanderbilt Locomotive Boiler with Corrugated Firebox.

For more than two weeks there has been running in regular freight service on the New York Central & Hudson River Railroad, a locomotive (No. 947), having a single corrugated firebox, made from designs of Mr. Cornelius Vanderbilt, Jr., M. E. The feature of particular interest about the locomotive is the departure from the ordinary construction in the design and suspension of the firebox, as clearly shown in the accompanying engravings. The locomotive is a ten-wheeler, built at the Albany shops of the road when Mr. Buchanan was Superintendent of Motive Power, and weighs complete 160,000 lbs., 113,300 of which is on the drivers, and 46,700 lbs. is on the truck. It has 19½x26 in. cylinders, and 61-in. drivers. The total heating surface is 2,356.27 sq. ft., the tubes 2,164.56 sq. ft., and the firebox 191.71 sq. ft. The firebox surface is figured for a plane cylinder, no account being taken of the small extra surface due to the corrugations. The grate area is 35.2 sq. ft.

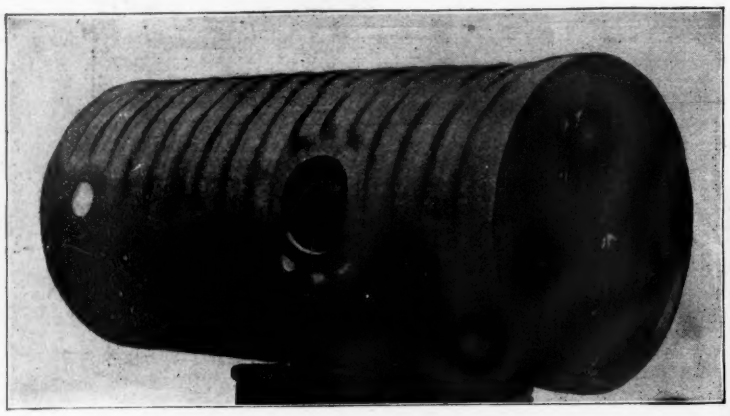


Fig. 1.—Corrugated Firebox, Used on Engine 947, New York Central Railroad.

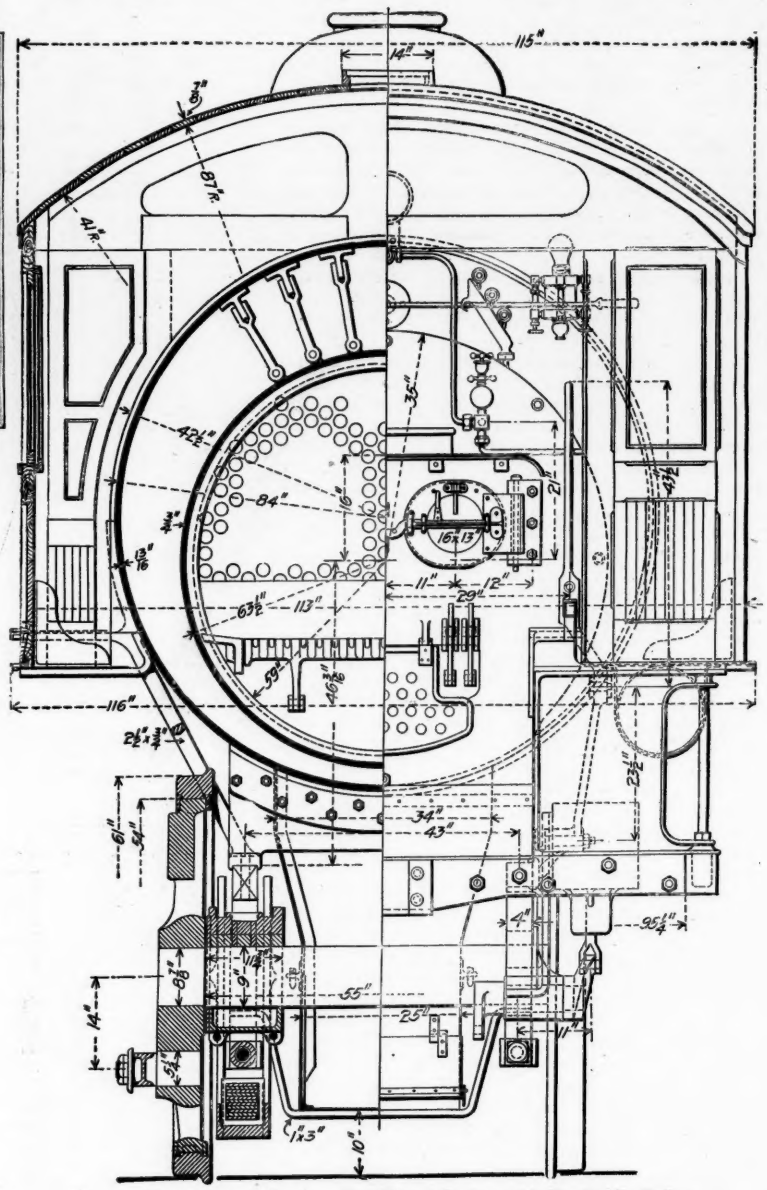


Fig. 4.—Elevation and Section, Ten-Wheel Engine with Vanderbilt Boiler.

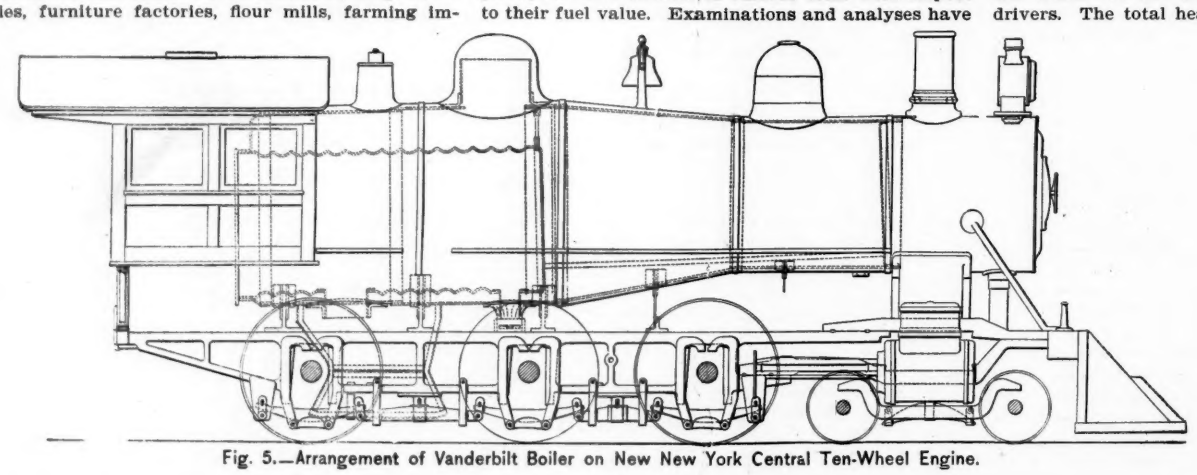


Fig. 5.—Arrangement of Vanderbilt Boiler on New New York Central Ten-Wheel Engine.

The firebox is a corrugated cylinder of the Morison type having an external diameter of 63⅜ inches. It was made by the Continental Iron Works, Brooklyn, and we believe this is the largest corrugated furnace which has ever been made. It was rolled from ¾-inch steel, and was tested under external pressure to 500 lbs. per sq. in. before being put in the boiler. As shown in Figs. 2, 3 and 4, it is carried at its front end by a row of slingstays, and the pressure tending to force it to the rear is resisted by the tubes, by the stays which are fastened to an annular reinforcing plate, and at the front end by the waist of the boiler, to which the firebox is fastened.

The grate area, 35.2 sq. ft., is larger than the standard grates used with engines of this type on

the New York Central. Rocking grate bars, with interlocking fingers, are used, and the air supply for the grates passes through the 18-inch thimble, the air being taken into the ashpan through adjustable dampers. The eight-inch hole also shown in Fig. 2 is for the purpose of cleaning out ashes, and is closed by a steel cover when the engine is running.

The front of the grate is eight inches lower than the rear end. It is carried by bearers which rest in front on the bridge wall and at the rear on the frame (lined on the inner side with firebrick) by which the front of the firebox is closed.

In the design of the boiler it will be evident that Mr. Vanderbilt's aim has been chiefly to dispense with the staybolts. This, in the end, it is believed, will reduce the expense of maintenance. This type of boiler for large locomotives will weigh less than one of the common construction.

From the performance of the engine since it has been turned out of the shops, every reason can be

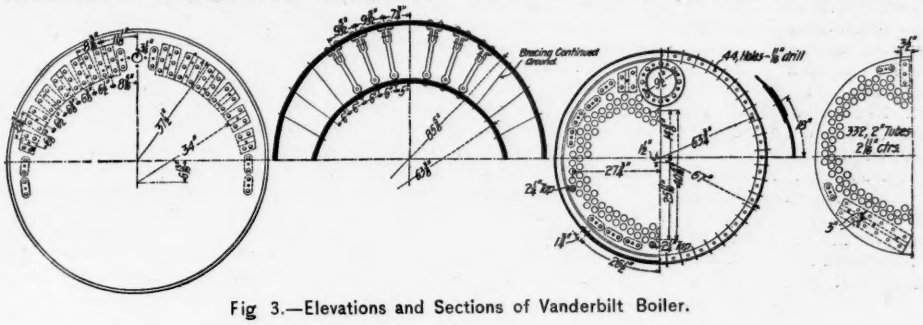


Fig 3.—Elevations and Sections of Vanderbilt Boiler.

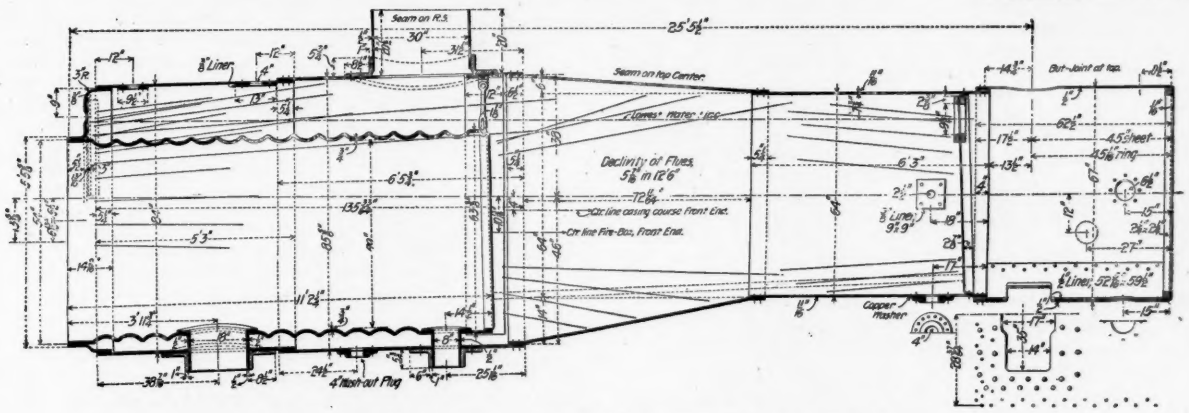

Seam on R.S.
Seam on Top Center
Declinity of Flues, 5/8" in 12'6"
Ctr. line casing course Front End.
Ctr. line Fire-Box, Front End.
Copper Washer
4 Wash-out Plug

Fig 2.—Longitudinal Section of Vanderbilt Corrugated Firebox and Boiler.

entertained for its satisfactory running. On the second day out, while drawing 63 empty freight cars, both safety valves blew off at 195 lbs. As noted before, the engine is designed for 185 lbs. The only carefully recorded test shows for the run an average speed of 20.4 miles, and the maximum 30 miles an hour. The actual evaporation was 8.6 lbs. of water, which figures approximately to 10.3 from and at 212 deg. F. The pop valves were set at 180 lbs. The data from this preliminary trial of Aug. 16 are as follows:

Mean temp., atmosphere	78 deg. F.
Temp. water	71 deg. F.
Direction of wind	Unfavorable
Velocity	Light
Condition of rail	Good, dry
Exhaust nozzle	Double, 3¼ tip
Left West Albany	9.45 A. M.
Arrived at DeWitt	6.00 P. M.
Elapsed time	8 hours 15 min.
Slow downs	6
Dententions	8
Time lost by detentions	1 hour 24 min.
Running time	6 hours 51 min.
Distance	140 miles
Speed, miles per hour, running time	20.4
Coal used, actual	12,390 lbs.
Water used, gallons	12,290.6
Water pounds	107,571.6
Evaporation per pound coal	8.6
Weight of train, tons, 2,000 lbs. each, exclusive of engine and tender	924.495 tons
Weight of train, including engine and tender,	1,054.495 tons
Train, 60 light, 1 load, 1 caboose	
Coal per car per mile	1.43 lbs.
Coal consumed per 100 tons hauled 1 mile	9.4
Tons hauled 1 mile per pound coal	10.4
Tons hauled 1 mile per pound water	1.23
Average temperature smoke box	275 deg. F.

Up to this week, the engine has been running in regular freight service, but trials are to be made in regular passenger service.

This, of course, is not the first time that corrugated

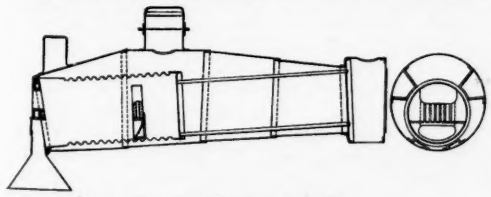


Fig. 6.—The Lentz Boiler.

fireboxes have been tried on locomotives, probably the best known being that by Lentz, the general design taken from Demoulin's recent work on the locomotive is shown in Fig. 6. While there are superficial resemblances between this one and the Vanderbilt design, it should be stated that the latter designs were completed before Mr. Vanderbilt had seen the Lentz design. More may be said if further tests show as satisfactory results as the first trials.

Improvements on the Erie.

From the annual report just issued we gather the following notes of improvements lately made or to be made on the Erie.

New rail, to the extent of 19,499 tons of 90-pound and 2,911 tons of 80-pound, were placed in the track, with the necessary frogs, switches, etc. Heavy expenditures have been made for repairs and renewals of bridges and culverts, the object being to ultimately place these structures in a practically permanent condition. It is contemplated, during the coming year, to renew the Kinzua Viaduct. Three iron bridges have been renewed with heavier steel structures, four wooden bridges replaced with metal structures, two of new steel and two of iron remodeled from bridges taken from other points; and two deck plate steel girder bridges were put in, one to replace a culvert and the other to carry the track over a small water-way; one wooden highway bridge was replaced with steel, and one highway bridge has been remodeled and widened. Extensive repairs have been made to trestles, and twenty-five trestles have been filled in, one trestle replaced with an iron bridge, and one trestle partially filled in.

New 65-foot turn-tables were put in at Suspension Bridge and Jersey City. This latter table is operated by electricity, and is giving excellent service both in the despatch with which locomotives are handled and the reduced cost thereof. Gasoline engines have been installed at five water stations, resulting in a material saving in the cost of pumping. During the year 104,908 feet of company's siding have been constructed; 16,215 feet of private side tracks were constructed during the year.

The policy of remodeling light-weight, low-pressure consolidation locomotives by the application of high-pressure Wootten boilers and new cylinders, thereby increasing the capacity, besides permitting the satisfactory use of a much cheaper grade of fuel, was continued during the year, thirty-five engines being remodeled in the company's shops and ten by outside locomotive builders. Twenty new tenders were built at the company's shops and three new steel tender frames. In complying with the law, 211 automatic pilot couplers and 97 tender couplers were applied.

During the year 15,273 east-bound cars were handled at the Bergen transfer in such a manner as to reduce the number of cars that would otherwise have passed one way through the tunnel 18,734, equal to 749 trains of 25 cars each, resulting in a large saving in switching expenses at Jersey City, as well as greatly relieving the tunnel.

The Brown hoist at Buffalo transferred 105,054 tons of coal. The Dodge coal storage plant at Buffalo handled 105,573 gross tons of coal. During the year 394,252 tons of ore was handled over the Buffalo ore dock. The coal unloader at Cleveland handled 23,435 cars of coal, or 561,319 tons. This unloader will have to be rebuilt and enlarged during the coming year, in order to take care of the larger cars now being used in the trade.

The greater portion of the equipment turned over to this company at its organization consisted of small, antiquated cars, and additional modern equipment was a necessity in order to keep abreast with the progress made in the transportation business and meet the competition which exists in this respect. Still further expenditures will be required, from time to time, in this direction, not only for the reasons stated, but also to enable the company to continue its efforts to reduce the cost of handling its traffic. More powerful engines and larger cars are material items in cutting down expenses.

In accordance with the United States and State laws, the work of supplying air-brakes and automatic couplers to the freight equipment has been continued during the year, and the cost, as heretofore, has been charged to current operating expenses. About 30 per cent. of the engines and 18 per cent. of the cars yet remain to be equipped with couplers, while about 60 per cent. of the cars and 4 per cent. of the engines need air-brakes.

All the foundations for the bridge and super-elevated structure for the Penhorn Creek Railroad have been completed, and practically all necessary right of way purchased, but the Board has not deemed it wise to begin the construction of this road until the elevation of the tracks at Jersey City is entirely completed. The building of the road will then be further considered.

Owing to legal complications, no work has been done in the construction of the Goshen Railroad, and the work on reducing the grades at Goshen is therefore temporarily suspended. Contracts have been made for the reduction of the grade near Howells, N. Y., and it is expected that this work will be completed before the end of the year.

An east-bound polling yard is being constructed at Hornellsville, N. Y., a much needed improvement and one which will greatly facilitate the handling of business at that terminal. This work will cost about $17,000, all of which will be taken care of in the operating expenses.

Good progress has been made in reducing the eastbound grades at Wellsville, N. Y., on the Allegheny Division.

The increasing weight of trains and rolling stock has made necessary the rebuilding of the Kinzua Viaduct, on the Bradford Division The contract has been let for this work, but owing to the delay in receiving material the construction of the new bridge will not be begun until next summer.

The second track between Meadville, Pa., and Buchanan Junction has been completed and greatly facilitates the west-bound freight movement out of Meadville Yard, on both the main line and the Franklin branch. The cost of this work has been charged to operating expenses.

The grading for the proposed second track between Shenango and Pymatuning, and between Sharon and Sharpsville, on the Mahoning Division, is rapidly approaching completion.

The general question of separating the grades of streets and highways from the company's tracks has received much consideration during the year. The State of New York has recently passed an act arranging for the gradual removal of grade crossings, and plans and contracts covering several crossings are under discussion. The probability is that the company will find it necessary to make large expenditures annually for the removal of grade crossings for some time to come, but the Board feels that the ultimate benefits to be derived from the removal of this source of danger and expense will amply compensate for the expenditures made.

Foreign Railroad Notes.

Russian journals have lately published notices that the Irkutsk-Lake Baikal line of the Trans-Siberian Railroad is open for the regular movement of merchandise. The road invites shippers to secure cars with their own seals, and besides to send with the goods one guard for each car. This part of the line is about 65 km. (40 miles) long. The luxurious train which for several months has been run between Moscow and Tomsk, and then to Krasnovark, now goes twice a month to Irkutsk, so that it is now possible in about 12 days to make the journey from Moscow to Irkutsk, in the center of Asia. Beyond Baikal, track laying has been delayed on account of the cold weather, but there are several sections where the rails have been laid for 25 to 50 km. (15 to 31 miles), and work trains have been running, so that by the middle of the present season it is expected that the line will be completed between the east bank of the Baikal and Stretensk.

The Milan-Laveno Railroad, Italy, 45 miles long, is to be equipped with electricity. The power is to be taken from the Tessin River and transmitted at a pressure of 10,000 volts, which is to be converted into a continuous current of 700 volts by transformers located at convenient points along the line.

RAILROAD GAZETTE

ESTABLISHED IN APRIL, 1856.
PUBLISHED EVERY FRIDAY,
At 32 Park Place, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussion of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

It is hard to fully realize how great is the demand just at present for all sorts of railroad materials and equipment, and the statement of a man long connected with one of the largest locomotive works in this country is especially interesting. He said that particular company now has orders that will keep its plant running to the full capacity until next April, and it is safe to assume that other builders are similarly fixed. Railroads placing orders now cannot get deliveries much under seven or eight months. It is also stated that this is the first time within fifteen years that this particular locomotive building company has found it unnecessary to solicit orders, and, further, that it is now impossible to accept all of the business that comes unsolicited through correspondence.

The Holman "speeding truck," or Holman locomotive, seems to have as much vitality as a cat. We supposed that it was dead a year ago, but a reader of the Railroad Gazette writes to us to say that an agent of the company is trying to sell its stock in his town and to ask advice as to buying it. It is not necessary to say a word about the matter to those who are accustomed to the analysis of machines, or even to those who are reasonably familiar with the locomotive engine without having much knowledge of mechanical principles in general. But for the benefit of those who may possibly be hankering around this investment and who are not qualified to judge of the efficiency of the mounting of a grindstone, it is perhaps worth while to say that the Holman scheme is about as flagrant a piece of nonsense as ever pretended to be a locomotive. That which the inventor aims to accomplish can be easily accomplished by changes in proportions of the ordinary details of ordinary locomotives. He introduces something like 20 additional wheels, with all their bearings and journals, and consequent friction and cost of maintenance, and makes a remarkably wasteful engine. He also makes a remarkably dangerous one.

Some English Failures in Signaling.

The last quarterly train-accident record issued by the British Board of Trade, which is for the first three months of the current year, contains a number of investigations which will be of interest to signal engineers and superintendents. The two most unusual cases are those at Pollokshaw and Witham, where lack of adequate inspection of apparatus led to collisions. Another collision was due chiefly to the neglect of a signalman to put his signal promptly to danger after the passage of a train, but also in part to the neglect of an engineman to fully grasp what was required of him when running under permissive signaling regulations.

Another case deals with the use of the "section clear but station blocked" signal. In this, as in many previous cases of a similar kind, the inspector disapproves the use of this arrangement; but to Americans the significant feature of the report is the incidental information that this practice, which in effect puts English block signaling in the same category with American, is apparently quite common.

The Pollokshaw collision occurred at 7.20 p. m. on Feb. 11. A passenger train of the Glasgow & South Western ran into a freight of the Caledonian Railway on the Glasgow, Barrhead & Kilmarnock joint line. The freight was moving in the same direction as the passenger, pulling from a siding to the main track; 13 passengers were injured. It appears that north of Pollokshaw station there are loop lines about 1,500 ft. long; the signal box is near the station, and at the north or outgoing end of the loop tracks is the north signal box, which has no regular attendant in charge but is controlled from the south box by a mechanical locking arrangement fixed midway between the two boxes. On the evening in question, a freight conductor at the north box signaled the south box for leave to move his train out of the loop. Permission was refused because a passenger train was approaching from the south. The conductor went outside, and returning, a minute or two after, thought he heard the bell give three beats, allowing him to turn the switch. He did so, first pulling a releasing lever (which ought to have checked him, but did not), and his train pulled out, being struck soon after, as before stated. Investigation showed that the timber beam supporting the crank brackets in the cabin had become decayed, so that the releasing lever could be moved when the lock at the south box, which should have held it fast, was still undisturbed, the bracket pulling out of the rotten timber. The timber had been in position about seven years and the box is said to have been repaired in February, 1898, but these repairs evidently were not very thorough. The freight conductor was censured for not having made sure that he received the proper bell signal; but the blame is fixed on the persons responsible for keeping the apparatus in good order. The government inspector, Colonel Yorke, believes that if the machine had been examined at suitable intervals, and while the levers in the frame were being worked, the defect in the timber would have been disclosed. Incidentally it was shown that passenger trains were allowed to run through the loop line, which is signaled as a freight line only, and the railroad company is reminded that this is contrary to the law of 1889.

At Witham, on the Great Eastern, January 1, about 7.30 p. m., a passenger train ran into a cattle train at a crossing and there was a considerable smash-up. In this case the passenger received a signal at the last preceding station, warning it that while the section was clear to Witham home signal, the crossing beyond the home signal was blocked. On reaching the Witham distant signal, the engineman found it against him and he shut off steam, but the home signal was at all-clear, and he passed it at about 12 miles an hour, striking the freight immediately after. It appears that the last preceding train using this signal had gone by at 4.37 p. m. (it was Sunday), and that after the passage of that train the signalman put his lever normal; but the arm remained off, owing to the vertical rod on the post having become jammed under the cover plate of the slotting apparatus. There was a back light which should have indicated to the signalman the position of this signal; showing when the signal was in the horizontal position and invisible when it was in the all-clear position. The signalman, it appears, could see a white light on the night in question, which accounts for his assumption that the signal was in the stop position, but the white light which appeared when the signal was off was produced by reflection from the lower corner of the green spectacle. A screen might easily have been fixed so as to hide this light; and this, in fact, was done after the accident.

The inspector, Colonel Addison, condemns the negligent habit of the signalman in not noticing the behavior of the back light when he moved the signal; and the fitter, who should have detected the deceptive light, should have carefully examined the signals by night as well as by day. It appears that this signal had once before failed to go to danger, but when subsequently tried it seemed to work all right, and the inspector or repair man was not notified. Colonel Addison finds that the order "section clear but junction blocked" is used very frequently, which practice "is to be deprecated."

At Three Counties, on the Great Northern, Jan. 31, a short special freight train, having been admitted to a block section under a permissive signal, ran through the length of the section and collided with a gravel train, killing one laborer and injuring six others. On approaching Three Counties (at the outgoing end), the engineman found the distant signal off and concluded that the preceding train had been set off. He therefore gave his engine steam and the collision resulted. The distant signal had been pulled off for the gravel train and had not been put back. Whether or not the home signal had been put back is doubtful, as the evidence is conflicting. The signalman is held primarily responsible, but the engineman is blamed for so hastily assuming that the gravel train had cleared the main track. This engineman had been on duty 12 hours, which is mentioned as a possible ground for leniency. There was a little fog at the time, but only a little, and the track foreman, after consulting with the signalman, had decided that fog signaling was not necessary; but Colonel Yorke thinks fogmen should have been out, as "it is better to err on the side of prudence." If there had been a fogman at the distant signal the collision probably would not have occurred. Colonel Yorke thinks that "permissive block" is an erroneous and misleading term; "permissive system" would be more correct.

Sir Francis A. Marindin, in reporting on a rear collision at Strood, on the "South Eastern & Chatham & Dover," Jan. 20, calls attention to the fact that trains are allowed to run from Rochester to Strood when the track at Strood is occupied, without giving the "section clear but station blocked" signal, as required by the uniform code. One of the trains involved in this Strood collision had most of its cars fitted with Westinghouse brakes, but there were three at the rear with the vacuum brake, so that the train, when running, had three vehicles the brakes of which were not within the engineman's control, which was a breach of the law of 1889.

Annual Reports.

Erie Railroad.—The annual report of the Erie Railroad for the year ending June 30, 1899, was issued last week, being the fourth annual report of the reorganized company. A high officer of the company recently said that the only man he ever heard of who could have managed the Erie properly was Pharoah, who knew thoroughly the art of making bricks without straw. The report this year is a continuation of the story of a resolute and able struggle against a trying set of conditions. It is the story of working 2,272 miles with the result of gross earnings, $33,752,704; expenses and taxes, 74.57 per cent. of these earnings; net from operation, $8,582,778. A little over half a million of income was received from securities owned, etc., and interest and rentals were paid to the amount of $8,486,555. The surplus left and carried to profit and loss was $653,798, or 1½ per cent. on the first preferred stock.

The interest charges on the funded debt amount to $6,842,679, and interest on equipment trusts and mortgages brought the total of interest up to $7,037,931 which alone would account for $3,100 of net earnings per mile of road worked, and this is $1,100 more than the average net earnings per mile of all the railroads of the United States. The rentals amounted to $1,448,624, which would bring the fixed charges up to $3,740 per mile of road. Of course the Erie is a trunk line, with capacious and valuable terminals and ought to earn a good deal more than the average railroad. It serves some good territory, many large and prosperous towns, and has a great coal traffic. Yet the bulk of the mileage is through a country of only average wealth. It could not be compared, for instance, in this respect with the line of the New York Central and with much of the line of the Pennsylvania; nor can its coal traffic be worked as cheaply, for example, as that of the Chesapeake & Ohio and the Norfolk & Western. So while the Erie earns $14,850 gross per mile, $3,740 net can be earned (with the low rates which can now be got), only by constant skill and vigilance.

In fact the rate received for carrying freight has fallen very low. Last year it amounted to 5.17 mills per ton-mile, which was a decrease of 7.35 per cent. from the preceding year. The average rate for the United States for the year ending June 30, 1898, was 7.53 mills; and for groups II. and III., in which the Erie lies, the average was 6.17 and 5.78 mills. In the four years during which the present company has had full control its freight rate has fallen off 0.71 mill per ton-mile, or nearly 12 per cent. If the rate of 1895 and 1896 could have been received this last year the net revenue would have been $3,432,690 more than it was, and this gain would have amounted to 8 per cent. on the first preferred stock. This is the significance of a fall in rate of only 0.71 mill, or less than 14 cents on each ton carried. These figures indicate how close to the wind the Erie must sail with competition forcing down the rates and with its great burden of debt.

While the gross earnings increased last year by a little less than $12,000 the expenses of working decreased $268,000, and thus the officers of the company were able to produce an increase of net earnings of $280,000 and to reduce the ratio of expenses to earnings from 75.39 per cent. to 74.57. This was accomplished in the face not only of falling rates, but of increasing cost of all material and supplies. The President says that a careful estimate indicates this increase to have been about 33 per cent. in the last half year, and obviously this was a very serious addition to the cost of working. The decrease in expenses was chiefly in maintenance of way and structures and of equipment, where a saving was effected of $492,655. Conducting transportation and taxes were both increased by considerably more than $100,000 each.

The first criticism will be that this saving in cost of operation is an abnormal one and that future years will have to pay for it. Looking at the analysis of the expenses we should say that this is by no means certain. One of the greatest single items of saving, for instance, was in ballast; but a great deal of money has been spent in recent years to bring the track up to a high condition in this

respect, and it is by no means certain that the same average amount must be spent in years to come to keep it there. Something of the same kind may be said of the item of renewing ties, in which $41,000 was saved last year over the preceding year. This item, however, must be treated with a good deal of circumspection. In repairs and renewals of buildings, docks, etc., a saving of about $127,000 was made last year, and here again there is no reason to assume that this part of the property was neglected. On the other hand, the items of rails and rail fastenings were actually increased last year. Incidentally the cost of removing snow and ice (about 2½ per cent. of the maintenance of way and structures) was more than doubled.

In examining the items of maintenance of equipment we find that repairs and renewals of locomotives were very considerably increased, repairs and renewals of shop machinery and tools also increased somewhat, while repairs and renewals of freight cars, passenger cars and marine equipment were very much less. Without knowing the inside facts nobody is justified in assuming that an artificial economy has been forced in these items for the sake of bringing out a balance on the right side.

Nevertheless, the situation is serious enough to cause the officers administering the affairs of this company a good many anxious days and nights and to justify them in wishing that they could find Pharoah to help them out. For instance, there was an actual loss in the year's operations of more than a quarter of a million dollars in carrying freight and the freight earnings, including coal, are 74 per cent. of the total earnings of the system. Yet the ton-miles increased 6.11 per cent., reaching the great figure of 4,835 millions, but the fall in the rate was sufficient to more than neutralize the gain which the railroad compa y had a right to expect from this part of the traffic. Fortunately, the transportation officers were able to run the train-load up 7.28 per cent. over last year, or to 335.46 tons. The average carload was increased 6.33 per cent. The average cost of carrying a ton of freight a mile was decreased three-fourths of one per cent. and amounted to 3.97 mills, or, excluding taxes, to 3.597 mills. An interesting and useful analysis could be made of the comparative capacity and efficiency of the locomotives and freight cars between now and four years ago, but into this we cannot at present go. The President says that the company has no doubt secured its share of the moving traffic, but that the unit of cost and the unit of revenue are much too near together.

The passenger traffic gained reasonably, and indeed almost made up for the loss in merchandise freight and coal. The increase in passenger earnings amounted to over one-third of a million dollars, and there was a small increase in express and in miscellaneous. The gain in passenger revenue amounted to 5.92 per cent., while the increase in passenger miles was 6.94 per cent., which means that the rate per passenger per mile fell off. Indeed it reached the low average figure of 1.54 cents. The average for the United States is 1.973 cents and for Groups II. and III., 1.786 and 1.945 cents respectively. The great gain of the Erie has been in local traffic. Of the total number carried 14,733,000 were local passengers and 489,000 were through passengers, the through travel having actually decreased in numbers. The company's suburban business is growing steadily, "and while the rates are low and the service expensive the increasing volume gives a fair return in revenue." Probably the Erie will see a steady growth in this branch of its revenue, for it now commands a very fine suburban territory.

A few extracts from the annual report, giving information as to changes in equipment, structures, etc., will be given in other columns in this or a later issue.

Denver & Rio Grande.—The Denver & Rio Grande, whose annual report for the year ending June 30, 1899, is at hand, earned $9,270,248 gross in that period, or only $47,400 less than in 1893, the most prosperous year in the company's history. If we include receipts from all sources, the total income was slightly above the 1893 figures, but the net earnings from operation, were $475,000 below the total of that year. The fact that the company has practically equalled the gross revenue of 1893 is one of the most remarkable recoveries of revenue, of the many records of improvement, brought about by the returning tide of prosperity. In the collapse of the silver mining industry in 1893, the Denver & Rio Grande lost about a third of its gross revenue and about 38 per cent. of its net receipts in one year. The course of these two items since then is shown in the following table, the mileage varying from 1,646 in 1893 to 1,670 in 1899:

	Gross earnings.	Net earnings.
1899	$9,270,248	$3,559,897
1898	8,342,926	3,325,327
1897	6,945,115	2,869,778
1896	7,551,187	3,202,406
1895	6,916,841	2,925,629
1894	6,476,011	2,503,492
1893	9,317,647	4,035,562

As compared with 1898, the figures for last year show an increase of $927,322, or 11.21 per cent. in gross, and of $234,570, or 7.1 per cent. in net. The gain in freight receipts has been by far the largest part of the additional revenue—$780,027 last year, and $1,287,166 in 1898. In the two years, passenger revenues have gained $246,000. In both years the increases in net have been only comparatively moderate, the expansion in expenses, of which a considerable share was due to increased maintenance charges, absorbing the largest share of the additional income received.

The surplus accounts, however, have gained largely in recent years, enabling the company to pay 2½ per cent. to its preferred stockholders in 1898 against 2 per cent. in 1897, and to put these shares on a regular 4 per cent. annual basis in January of last year. The dividends deducted out of last year's income were therefore equal to 4 per cent. The balance earned for the stock, as shown below, was equal to 5.65 per cent., or $438,227 above last year's figure. Various special appropriations, including additions to renewal funds, the expenses of refunding the old 7 per cent. bonds into 4½ per cents., and the cost of 16 standard gage locomotives, amounting altogether to $388,320, were deducted from the year's income, leaving a balance of $33,000. The details of the income account, as compared with 1898, follow:

	1899.	1898.
Total net income	$3,670,224	$3,387,729
Bond interest	1,900,810	1,997,950
Total charges	2,333,495	2,489,227
Balance	$1,336,729	$898,502
Dividends	(4pc)946,000	(2½pc)591,250
Surplus	$390,729	$307,252
Renewal funds	60,000	30,000
Bond conversion fund	120,000	20,000
New equipment	177,590	.....
Balance	$33,139	$257,252

Of the increase of $692,751 in expenses, $105,600 was due to higher cost of maintenance of way, and $120,703 was due to higher equipment charges. These changes follow increases in 1898 of $194,000 in roadway expenses and of $191,000 in equipment charges. The largest single increase in maintenance of way expenses was for keeping the line open through the unusually prolonged and severe winter. The expense on this account was $109,000, or 3½ times the cost in the previous winter.

The financial tables in the report are unusually complete, and the statements set forth with exceptional clearness, the hand of the experienced comptroller, Mr. Little, showing in this work. It is rather curious, however, that there are practically no operating statistics, even the commodity table, which has heretofore been given in excellent shape, being now omitted. This makes the omission of operating statistics pretty nearly complete, except as regards the car mileage. The company has not been accustomed to give its ton-mileage, ton-mile rate, train-load or train-haul, and only the local train-miles. The operation of part of the mileage as standard and part as narrow gage, probably accounts for the omission of some or all of these statistics, but this explanation does not apply to the tonnage table.

Chicago & Eastern Illinois.—The chief business of this company is carrying coal, but it also has a good business in general freight, and considerable passenger travel, particularly in the suburban district. Its report for the year ending June 30, last, just issued, reflects the improvement in these various classes of business, which enabled the company, besides paying the regular 6 per cent. dividend, on about $6,000,000 of preferred stock outstanding, to increase the dividend rate on something over $6,000,000 of common stock, from 2½ per cent. paid in 1898 to 3½ per cent. in 1899, the shares being now on a 4 per cent. annual basis. There was a balance after meeting these dividend payments, and the charges on about $20,000,000 of bonds, of $200,000, half of which was appropriated for additional equipment. The comparative income account for 1899 and 1898 follows, the results being based on 648 miles operated in both years:

	1899.	1898.
Pass. earn	$797,387	$709,343
Freight earn	3,638,721	3,379,462
Gross earn	4,581,560	4,221,438
Oper. exp. and taxes	2,712,920	2,619,632
Net earn	$1,868,640	$1,601,806
Total net inc	$2,065,329	$1,768,091
Fixed charges	1,297,966	1,312,704
Balance	$767,364	$455,387
Dividends	566,765	444,787
Surplus	$200,599	$10,600

The chief interest in the report lies in the operating statistics, and particularly the heavy increase in the freight train or engine load. This increased no less than 45 tons to 414 tons, which brings the figure very close to the 425 tons reported by the Chesapeake & Ohio, a road so differently situated. Both companies, however, have the advantage of a very heavy traffic in coal, moving in fully loaded and unbroken trains. The train load of the Chicago & Eastern Illinois has not heretofore been given in the reports, but it may be stated as 361 tons in 1897, 365 in 1896 and 312 in 1895. The increased density of traffic in 1896, the ton-miles gaining 19½ per cent. in that year, seems to have had a good deal to do with the sharp rise in the train load in that year. The betterment in 1899 is attributed by President Carpenter to the use of heavier locomotives. The more interesting operating statistics are given below for the last three years:

	1899.	1898.	1897.
Tonnage	5,538,429	4,784,375	4,582,668
Tons one mile	750,399,337	660,143,108	612,368,345
Av. train haul, miles	135½	138	133½
Frt. train mile. earn	$2.01	$1.89	$1.84
Ton mile rate, mills	4.85	5.12	5.09
Frt. train mileage	1,810,781	1,788,677	1,695,546
Av. train load (tons)	414	369	361
Loaded car miles	34,652,853	31,904,712	28,994,410
Empty car miles	23,411,195	21,364,632	20,714,194

It will be noted that the heavy train load now was obtained in the face of a considerable amount of empty car mileage, due to the fact that the coal cars run empty one way. The proportion of empty car mileage has not varied much over a series of years, but there is expectation that hereafter it will be largely decreased, through the 63 mile extension to the Mississippi River. Connection will be made, by means of a ferry transfer, with the St. Louis Southwestern, a road whose traffic is also of such a nature that a very considerable amount of empty car mileage has to be run. The new route, thus opened, would seem to have many advantages as a fairly direct line between Chicago and the Southwest. The traffic going south would be coal, machinery and general freight, and north-bound freight would be lumber and bulk tonnage, and the division of this tonnage would be such as to help in reducing the light car mileage of each company.

Metropolitan Street Railway Company.—The report of the Metropolitan Street Railway Company of New York for the year ending June 30 was filed with the State Railroad Commissioners on Tuesday of this week. The report shows an increase of $2,428,156 in gross earnings and $1,639,930 in net with a reduction in working costs from 52⅜ per cent. in 1898 to 48¾ per cent. in 1899. The reduced percentage of operating expenses to gross earnings of the company is partly due to the change of motive power on many of the lines. The gain from the change to electricity, however, was not fully obtained until March of this year. During July, August and September last the Sixth and Eighth avenue lines were practically closed and earned but little, and in addition to this the traffic for January, February and March, owing to the severity of the weather, was relatively less than ever before since the road has been running, except in 1888. The total number of car-miles run last year was 41,760,856, while for the year before, as given in our issue of Nov. 4, 1898, was 35,096,000. The report for the year, compared with the two previous years is as follows:

	1899.	1898.	1897.
Gross	$13,158,631	$10,730,474	$8,888,805
Oper. exp	6,408,711	5,620,484	4,810,235
Net	$6,749,920	$5,109,990	$4,078,570
Prop. exp. to gross	48¾	52⅜	54⅛
Charges	4,477,758	3,609,966	3,155,250
Balance	$2,272,162	$1,500,024	$923,320
Total income	2,639,056	1,845,570	1,439,123
Dividends	2,471,675	1,500,000	1,200,000
Surplus	$167,381	$345,570	$239,123

This report is of especial interest in comparison with that of the Brooklyn Rapid Transit Co., an abstract of which was printed in last week's issue, page 599. It was pointed out that the Metropolitan Street Railway Co. exceeds in its volume of earnings the Brooklyn Rapid Transit Company, though having less than half the track.

The now famous Atbara bridge was officially opened August 26. Lord Kitchener in his address spoke of the difficulty in getting his requirements filled promptly and was "delighted to find that our cousins across the Atlantic stepped in. The opening of this bridge to-day is due to their energy, ability and the power they possess in so high a degree of turning out work of this magnitude in less time than it can be done anywhere else." Lord Kitchener also congratulated the American foremen. They showed under the difficulties with which they had to contend "the real grit they are made of." An unimportant London newspaper, the Evening News, remarks that "it remains to be seen whether this pin-built structure, built on lines condemned by all English engineers, will stand the Atbara's floods." The intelligence and precise knowledge displayed by this remark forestall any comment or criticism that we could possibly make.

NEW PUBLICATIONS.

A Practical Course in Mechanical Drawing. By William Fox, M. E., Assistant Professor of Applied Mathematics, College of the City of New York, and Charles W. Thomas, M. E., Instructor in Descriptive Geometry and Drawing, College of the City of New York. Small octavo, 98 pages, with illustrations and index. New York: D. Van Nostrand Co., 1899. Price $1.25.

In the preface to this little book it is said that it has been designed especially to meet the needs of high schools, schools for apprentices and young mechanics. The exercises are elementary and progressive and they are intended not only to teach the art, but to show what an average draughtsman should be able to accomplish. The scheme is to teach drawing by special concrete exercises and the usual introduction by geometric problems is omitted. The purpose is to teach by models and thus help the untrained imagination of the pupil. The first exercise is to draw three views, front, side and plan, of a simple solid form bounded by straight lines. A perspective sketch of this form is given with dimensions and the pupil is supposed to construct from this the plan and elevations. Practical instructions how to do this are given. In this way the pupil is led along from simple to somewhat complex drawings, and he is introduced to the use of the instruments required in the ordinary work of the me-

chanical draughtsman. In brief, the little book is an elementary primer and as such will be useful to those for whom it is designed.

TRADE CATALOGUES.

The Dixon Graphite Productions.—The Joseph Dixon Crucible Co. has sent us a new catalogue of graphite productions, the most important and interesting of which to railroad men are the various lubricants and paints. These will be found described at considerable length, with prices.

Hydraulic Jacks and Hydraulic Tools.—The Watson-Stillman Co., 204-210 East Forty-third St., New York City, sends us catalogue No. 54, dated July, 1899, dealing particularly with hydraulic jacks. It is an octavo pamphlet of about 60 pages with an excellent alphabetical index, which index refers to the "index of illustrated sheets" which we have mentioned before. Several new jacks are described in catalogue No. 54. The announcement is made also that a considerable number of jacks is kept in stock to be rented for periods of from one day up. Jacks of from four tons to 125 tons capacity can be hired in this way. We do not remember to have seen this announcement before.

Mogul Freight Locomotives for the Mexican Central.

The Brooks Locomotive Works have recently built some heavy mogul freight locomotives for the Mexican Central Railway. These have cylinders 20 by 26 in., driving wheels 55 in. in diameter, and are intended for a working steam pressure of 180 lbs. The total weight in working order is 156,000 lbs., of which 134,000 lbs. are on the driving wheels. The other principal dimensions are as follows:

Gage	4 ft. 8½ in.
Kind of fuel to be used	Bituminous coal
Weight of tender, loaded	91,300 lbs.
Wheel base, total, of engine	18 ft. 1 in.
" " driving	10 ft. 0 in.
" " total (engine and tender)	46 ft. 4¼ in.
Length over all, engine	31 ft. 5 in.
" " " total, engine and tender	56 ft. 2⅝ in.
Height, center of boiler above rails	8 ft. 11 in.
" of stack above rails	16 ft. 5⅝ in.
Heating surface, firebox	178 sq. ft.
" " tubes	1,942 sq. ft.
" " total	2,120 sq. ft.
Grate area	25 sq. ft.
Drivers, material of centers	Main cast steel, others cast iron
Truck wheels, diameter	28½ in.
Journals, driving axle, size	9 x 11 in.
" truck " "	5 x 10 in.
Main crank pin, size	6½ x 6½ in.
Piston rod, diameter	4 in.
Kind of piston rod packing	Mexican Central soapstone
Main rod, length center to center	9 ft. 11⅜ in.
Steam ports, length	18½ in.
" " width	1⅝ in.
Exhaust ports, length	18½ in.
" " width	3 in.
Bridge, width	1½ in.
Valves, kind of	Richardson balanced
" greatest travel	6¼ in.
" outside lap	1 in.
" inside lap or clearance	0 in.
" lead in full gear	1/16 in.
Boiler, type of	Belpaire
" material in barrel	Steel
" thickness of material in barrel	¾ in.
" diameter of barrel, outside	70 in.
Seams, kind of horizontal	Sextuple riveted butt
" " " circumferential	Triple riveted lap
Thickness of tube sheets	F. ¾ in. B. ⅝ in.
" " crown sheet	7/16 in.
Crown sheet stayed with	Radial stays
Dome, diameter	30 in.
Firebox, length	8 ft. 0 in.
" width	3 ft. 1¼ in.
" depth front to bottom of mud ring	76 in.
" " back	71 in.
" material	Steel
" thickness of sheets	crown 5/16 in. sides and back ⅜ in.
" brick arch	No
" water space, width:	Front, 4 in.; sides, 4 in.; back, 4 in.
Grate, kind of	Rocking finger
Tubes, number	320
" material	Charcoal iron
" outside diameter	2 in.
" length over sheets	11 ft. 7⅛ in.
Smokebox, diameter outside	71¼ in.
" length	56 in.
Exhaust nozzle	Single
" "	Permanent
" " diameter	4¼ in.
" " distance of tip below center of boiler	5⅝ in.
Netting	Plate
Stack, straight or taper	Taper
" least diameter	16 in.
" greatest diameter	20 in.
" height above smokebox	4 ft. 2 in.
Tender.	
Type	Swivel trucks
Tank capacity for water	4,500 gals.
Coal capacity	8 tons
Kind of material in tank	Steel
Thickness of tank sheets	Top and bottom, ¼ in.; sides 7/16 in.
Type of under frame	Iron
Type of truck	Diamond frame
Truck with rigid bolster.	
Type of truck spring	Double elliptic
Diameter of truck wheels	33½ in.
" and length of axle journals	4¼ in. x 8 in.
Distance between centers of journals	6 ft. 3 in.
Diameter of wheel fit on axle	5⅞ in.
" " center of axle	4⅝ in.
Type of truck bolster	Cast steel, box form
Type of truck transom	12 in. channel, 30 lbs.
Length of tender frame over bumpers	24 ft. 9⅝ in.
Length of tank	19 ft. 9⅜ in.
Width of tank	9 ft. 11¼ in.
Height of tank, not including collar	4 ft.
Height of tank over collar	5 ft.
Type of back drawhead	Link and pin
Without or without water scoop	Without

Special Equipment.

Tires	Krupp
Sight-feed lubricators	Nathan
Safety valve	Crosby
Sanding devices	Leach
Injector	Freidmann
Driver brake equipment	Westinghouse
Tender brake equipment	Westinghouse
Tender brake beam	Player
Air pump	Westinghouse
Air pump governor	Westinghouse
Steam gages	Crosby
Engine trick springs	Scott
Driving springs	Scott
Tender springs	Scott
Other Specialties: Johnstone blow-off cocks, made by the Crosby Co.	

Liquid Air for Locomotives.

The readers of the Railroad Gazette have been puzzled by some of the claims made for the economy and mechanical efficiency of liquid air as a means of developing the forces of Nature for the use and convenience of man. They need no longer grope in the dark. The letter below is from the center of light, and is an authoritative statement from a company which is using "liquid air" with some success for the heavy duty of hauling money out of the pockets of other folks. It sets forth the situation in beautiful simplicity.

Liquid Air, Power and Automobile Co.,
Boston, Mass., August 16, 1899.

Dear Sir.—In answer to your question as to our ability to secure 5 h. p. from 2, will state that through our power transmitter, by increasing the size of the front wheel and lessening the rear one, we are enabled to secure more leverage in the case of going up hill. By the movement of a small lever placed near the handles above, the speed of the carriage may be automatically changed to any desired speed; thus, if a hill was encountered the driver would change the lever so the carriage would ascend the incline at a slower speed, but with the expenditure of no more power than if the road was level.

It will be seen from this mechanism that we can run our carriages up hill with a 2 h. p. motor, whereas without this power transmitter it would be necessary to take a 5 h. p. motor to carry the same load. This is one reason why other automobiles are so very heavy. This power transmitter is on exhibition at our offices and has received the hearty commendation of every mechanic who has seen the same.

Liquid Air, Power & Automobile Co.

A Big Rogers Locomotive for the Illinois Central.

We have noted heretofore the fact that the Rogers Locomotive Co. will build an experimental consolidation engine for the Illinois Central. This engine will be of extraordinary weight and dimensions. A brief of the descriptive specifications follows.

Cylinders	23 in. x 30 in.
Drivers, number	Eight
Driving wheel material	Cast steel
" diameter	57 in.
Driving axle material	Nickel steel; journals 9 in. x 12 in.
Driving wheel base	16 ft. 3 in.
Total wheel base of engine	24 ft. 5 in.
Weight on drivers	194,000 lbs.
" " truck	20,000 lbs.
" total	214,000 lbs.
Heating surface, tubes	2,951
" " firebox	252
" " total	3,203
Grate area	38.5
Tubes, diameter	2 in.
" length	13 ft. 0 in.
" thickness	No. 11 B.W.G.
" number	417
" material	Iron
Grate, length	132 in.
" width	42 in.
Boiler, type	Belpaire
" diameter, inside front	78 in.
" material	Steel
" working pressure	210 lbs.
" thickness of barrel	⅞ in.
" " dome course	⅞ in.
" " crown	7/16 in.
" " tube	⅝ in.
" " side	⅝ in.
Wheels, engine truck, diameter	33 in.
" " kind	Steel tired
Tender, capacity	5,000 gals.
" frame	White oak
" trucks	Fox pressed steel
" wheels, diameter	36 in.
" " kind	Steel tired

The Railroads of China.

Lord Charles Beresford, in his book on the "Break-Up of China," devotes a chapter to a succinct account of the railroads and projected railroads of that country. From this chapter we condense the following notes:

The railroads actually in use are only two in number: (1) The line from Peking to Tientsin and from Tientsin to Shanhaikwan, 300 miles, and (2) that from Shanghai to Woosung, 17 miles. The first of these is that of which Mr. Kinder is Chief Engineer and with which our readers are somewhat acquainted. This road is double track, well built and maintained. The shorter road is poorly built and maintained.

Of the projected roads four are actually under construction, as follows:

(1) Peking to Hankow, 700 miles. The French-Belgian Company, holding the concession, has £5,000,000 capital, of which the French subscribed three millions and the Belgians two. It is the opinion of some that a rival project, the Tientsin-Chinkiang line, has better prospects than this company. The completed work on the Peking-Hankow line is at the north end, though a length of 12 miles has been graded at the south end. It is proposed to grade the whole line for double track, though only one track will be laid. Work is being actively carried on and a length of 55 miles, including a 10-mile branch to coal mines, has been finished. Progress, however, is slow, partly because His Excellency Sheng, who controls the line, has hitherto used no rails except those made at his own works at Hanyang. It was expected that the line would be opened for business to Pao Ting Fu this summer.

(2) The Shanhaikwan-Newchwang line is an extension northeastwardly of the 300-mile line now running. It was expected that this road would be open for business to Kinchow this summer. This line, though under Chinese control and administration, borrowed large sums of money from a British corporation. The line is a valuable one, as it passes the new treaty port of Ching Wang Too and extensive coal fields at Nan Paian. When it reaches Newchwang it will have the winter trade of Manchuria, which is now blockaded for five months in the year.

(3) Stretensk to Vladivostock. This is a part of the Russian-Trans-Siberian line and is built with Russian money. The construction work was going on actively when Lord Beresford was there.

(4) The Russian-Manchurian Railroad, a branch of the preceding, connects with Talienwan and Port Arthur. This, like the preceding, is built by the Russian Government for strategical purposes, but it will be valuable as a commercial line if trade is not restricted for political reasons. Over 150 miles of this line is graded.

The projected railroads on which no work has been done are the following:

1. Taiyuan Fu-Chengting, 130 miles.
2. Kiao-chow-Yichow-Tsinan, 430 miles.
3. Tientsin-Chinkiang, 600 miles.
4. Hankow-Canton-Kowloon, 700 miles.
5. Pekin Syndicate, 250 miles (not including branch lines).
6. Tonquin-Nanning Fu, 200 miles in Chinese Territory.
7. Langson-Nanning, 100 miles.
8. Pakhoi-Nanning, 120 miles.
9. Shanghai-Nanking, 180 miles.
10. Pu-kon-Hsin-Yang, 270 miles.
11. Soochow-Hangchow-Ningpo, 200 miles.
12. Burmah Extension to Yunnan, 300 miles.
13. Extension of the Shanhaikwan from Kinchow to Sin Min Thun, 97 miles.

On line No. 1 a party of French engineers was surveying. Line No. 2 is being surveyed by Germans. No. 3 has not been surveyed, though the contract is signed. This is an Anglo-German line. No. 4 is the American line, with which our readers are already familiar. Lord Beresford describes this as Anglo-American, but says that the Americans alone secured the concession for six-sevenths of it. He characterizes this as an extremely valuable concession. No. 5 is the line of the British syndicate which has the concession for enormous deposits of coal, iron and petroleum in the province of Shansi. No. 6 is a French line and some of the routes have been surveyed. No. 9 is partly surveyed. No. 10 is a concession held by a British firm, but nothing has been done. The same firm controls No. 11, which is said to pass through a very populous district. No. 12 will probably lie dormant until the Burmese Railroad is finished to the frontier of China. No. 13 is a proposed extension of the present line northeast of Peking, and promises to be a valuable line.

Lord Beresford says that from facts learned by him in China he thinks that lines ought to be surveyed for a railroad from Kweiking, capital of Kwanksi, to Kweiwang, capital of Kweichow; from Nanning Fy to Changsha; from Chungting to Ching-Tu and from Hangchow to Canton.

All the railroads proposed in China are to be built to the standard gage of 4 ft. 8½ in., except the Russian-Manchurian line, which is 5 ft.

Employees of the State Railroads of France.

Official documents just published show certain privilegs which have been granted since 1896 to the employees and agents of the French State Railroads. Before 1896 there was no general or uniform practice in the matter of advancement of the employees, and consequently there were many inequalities of treatment in the different departments of the service. The Administration has adopted the following rules, which govern the advancement of employees:

On the first of December of each year the heads of departments draw up two tables of promotions, one by selection and the other by seniority. Advancement is given by seniority in two-thirds of the positions for which the wages are not more than 2,100 francs at Paris and 1,800 francs in the country, and for one-third of the positions which carry a salary of from 2,400 francs to 4,000 francs at Paris and 1,800 to 3,000 francs in the country. One clause of the rules regarding the superannuation fund gives the Director the right to retire at his discretion, each year, employees who have reached the age of 55 years and who have had 24 years of service, but formerly the rules did not absolutely prescribe retirement of such employees, so that the Director might if he saw fit keep in service an employee who was no longer able to perform the duties required of him. This omission has been supplied by fixing the limit of age at which an employee must be put on the retired list at 64 years for those persons nominated by the Minister, and at 62 years for the officials nominated by the Director.

The admission to the enjoyment of the rights of the superannuation fund of workmen of the age of more than 35 years was the subject of a special act. Employees who could not be admitted on account

of their age at the time of their admission, receive a certificate of superannuation for old age. Five per cent. of their wages is retained, and the Administration pays a tax of an equal amount. All of the officials in the service since 1883 had the right to participate in the superannuation fund, but not all of them availed themselves of it. This was the case with certain track layers and some other employees. Since then these persons have several times expressed a desire to participate in this fund, but it has not been possible to do all they asked because of the expense involved, but the budget of 1898 has provided money to pay such employees the sum of ten per cent. Increase of salaries to the most deserving of those on the seniority list will hereafter take place each year. The sons or nephews of employees who are dependent upon them and who are suitable for apprenticed workmen, will be selected in this capacity before any other applicants.

The Ministerial circular of 1890 which fixes at ten hours the maximum daily average of work, and at twelve hours at the most any period of uninterrupted work, has been supplemented by measures enacted in 1896, since which the work of the engineers and firemen has been so aranged that they take as far as possible their rest at conveinent hours, and that each period of twenty-four consecutive hours shall have at least eight hours of uninterrupted rest; also inspectors shall not be compelled to work more than ten hours out of twenty-four, and they shall have at least twelve hours of uninterrupted rest before going on duty again. Some late instructions prescribe the furnishing of a substitute for not less than twenty-four consecutive hours once each month for all those employees in the train service, (1) who have not one day of rest of at least eighteen consecutive hours, or whose work comprises one or several periods of more than ten hours uninterrupted service, and (2) those who do not have at least twelve hours of continued rest. Since January 1, 1897, in order that the rest may be as complete as possible, those who are obliged to take out trains between 11 P. M. and 6 A. M. are called from their homes.

Premiums for economy have been revised in such a way as to give greater satisfaction, and the sum of 80,000 francs devoted to this purpose has made it possible to put the personnel of the State Railroads on a par with those of private companies. Since 1896 the increase of benefits to employees outside the amounts resulting from contributions have amounted to 340,000 francs, and a like sum has been voted by the management. Although the sum of 140,000 francs has been set apart in ten years for the increase of salaries, etc., there were still a few employees of the lower grades who had four or five years' seniority in their grades, who could not receive the proposed allowance because of the lack of funds. They have therefore been given an increase of salary with some additional work, and the sum of 100,000 francs has been devoted to this purpose.

The Uganda Railway.

Engineering (London) of August 11 contains a description, with two maps and a profile, of the Uganda Railway. For those who are particularly interested in this work the article will be valuable. It is drawn largely from recent blue-books and particularly from the report by Sir Guilford Molesworth, which we recently mentioned. The amount spent on this enterprise up to the end of October, 1898, was about $5,000,000. Sir Guilford Molesworth estimates the cost per mile, including rolling stock, at about $22,000. Up to the end of 1898 two hundred and twenty-seven miles of the line was open for freight traffic and 207 miles for passenger traffic. The work has been done under tremendous difficulties, as anybody might have known from the outset. The climate is very bad. For the first 250 miles the fly killed the beasts of burden; for the first 300 miles water is scarce and bad, and special water trains have to be run to supply the working parties. For practical purposes most of the country is uninhabited and nearly all the labor is imported from India. As many as 13,000 coolies have been employed at one time. Wages must be relatively high, and the workmen must be cared for in sickness as well as in health. "Practically, there was an army of 15,000 men in an almost waterless country, devoid of all resources and of all means of animal and wheel transport. Even at the base of supplies everything had to be imported from a distant country." The Chief Engineer actually in charge is Mr. George Whitehouse, M. Ins. C. E.

TECHNICAL.

Manufacturing and Business.

We recently reported that Valentine & Company, well known varnish and color makers, had bought additional property adjoining their Brooklyn works, and that plans had been filed with the Building Department for a large two-story building thereon. We now learn that the company has also filed plans for building at its Chicago works a large three-story building; the ground floor to be devoted to tanks and the storage of varnish, the other two floors to contain machinery and other facilities for the grinding and packing of colors and paints.

H. E. Keeler, formerly with the Adams & Westlake Co., has opened an office in the Havemeyer Building, 26 Cortlandt St., New York City, as a dealer in railroad supplies.

The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., has issued specifications for machinery and tools to be installed in the new machine shop now being built in the New York Navy Yard. The proposals will be opened October 10, 1899. The list includes planers, boring, milling and drilling machines, lathes, screw machines, turret lathes, shapers and a miscellaneous lot of machinery. Proposal blanks may be had by addressing the department.

R. C. Fraser, late with the Ramapo Iron Works, has been appointed Eastern Sales Agent for the Monarch Brake Beam Co., with office in the Havemeyer Bldg., New York City.

A "New Boyer" long stroke hammer was put in use at the Pressed Steel Car Company's shops in Pittsburgh, at noon Monday, August 21, and had been running continuously day and night up to the 28th, very rapidly and successfully, driving ⅞" rivets and with no breakage or stopping.

Mr. C. W. Kempton, Mining Engineer, has returned to New York after eight years' absence in Arizona, Mexico and Central America, and has reopened his New York office at 29 Broadway as a Consulting Mining Engineer. Associated with him is Mr. Percy B. McCoy, Mining Engineer.

Interlocking.

The compressed air interlocking apparatus installed by the Standard Signal Company for the Long Island Railroad near Jamaica has been put in operation.

The St. Louis, Peoria & Northern Railway has recently established at Hawley Crossing (the crossing of the Peoria, Decatur & Evansville tracks) a Rowell-Potter apparatus.

Electro-Pneumatic Signals in England.

On Jan. 15 an electro-pneumatic interlocking system was put into use in the Great Eastern Railway freight yard at Bichopsgate, London. This was built by Messrs. McKenzie & Holland, signal engineers, who are the sole licensees for the use of the Westinghouse signaling patents in the British Empire. The work was done under the general supervision of Mr. John Wilson, Engineer for the Great Eastern Railway Company. This, we believe, is the only installation of the kind in the United Kingdom. It has 38 working levers and nine spare spaces. There are 43 switches, 18 semaphore signals and seven ground disks. It is estimated that an ordinary interlocking frame of about 15 more levers would have been required to handle this work. The electric current is supplied by two sets of accumulators which are charged from the Great Eastern Railway Company's electric light mains.

Fall of a Steel Framework.

Last Monday the frame of the Coliseum Building in Chicago fell, resulting in the death so far of 10 men and the injury of a number more. The frame, which consisted of 12 arches, was being erected by the contractors, the Pittsburgh Bridge Company. Each arch is a three-hinged steel truss with a span of 150 ft. standing 66½ ft. from the ground at the highest point. These arches rest on concrete and pile foundations. The north arch fell first, falling to the south, and the other arches fell in succession. It is too early to give many particulars or to attempt to say just why the framework fell. The best opinion seems to be that it was due primarily to the fact that the diagonal bracing was not connected up between the two most northerly arches. The traveler at the north end was being taken down at the time and some think that an angular pull was brought on the arches by the ropes of the hoisting engine placed near the center of the building. One of the newspaper reports says that some of the material for the bracing had not yet been received.

Tests of Brakes for Street Cars.

The New York State Board of Railroad Commissioners commenced the series of 22 tests of brakes for street railroad cars on Tuesday of this week. The brakes were fitted to the cars of the Metropolitan Street Railway Co., New York, and the tests were made on the Lenox Avenue line between 146th St. and 116th St. Owing to the rain in the morning but two tests were made instead of four, as originally intended. A mechanical device was used to record the speed of the car when the brakes were applied and also to indicate the distance traveled by the car from the time the brakes were set until the car came to a stop. Tests were made at 8, 12, 16 and 18 miles an hour. The brakes tested were the General Electric Co.'s and the Devlin. No reports will be given out by the Commissioners until all of the brakes have been tested.

For Coaling at Sea.

A contract has been entered into by the Navy Department with the Lidgerwood Manufacturing Company to equip the collier "Marcellus" with a sea-coaling cableway, and a board of officers will try the device at sea. The work of the installation will be under the direction of Naval Constructor Bowles. In this device, the warship may take the collier in tow, or the collier may take the warship in tow, leaving a space between the ships of 300 ft. Elevated cables, leading from the masthead of the collier to shear poles on the warship, serve to support and propel a carriage, from which hang bags of coal. The coal is propelled across the space at 1,000 ft. a minute. The arrangement for compensating for the lurching of the vessels in seaway is ingenious, and has been tested on a small scale.

THE SCRAP HEAP.

By Trolley from Jersey City to Washington.

The newspapers are saying that the Pennsylvania Railroad Company will build a trolley railroad which "will have such connections and traffic agreements as will make a continuous trolley line from Jersey City to Washington." It is safe to say that this report is mostly nonsense.

Down with the Trusts.

"Here is the account of some train-robbers being lynched in Missouri." "Must be a fake." "No, somebody said the gang was incorporated under the laws of New Jersey."

Dortmund-Ems Canal.

Emperor William attended the opening of the Dortmund-Ems Canal, Aug. 11. Replying to an address of the Burgomaster, the Emperor said he regarded the canal as a work to form part of a greater whole, which he himself and the government had inflexibly determined to further, and he hoped the nation's representatives would put him in the position to do so before the end of the year.

Car Loads and Train Loads on the Erie.

Continued attention has been given to the consolidation of loading at transfer stations, resulting in an increased average tonnage per car of 1,880 pounds and effecting a saving of 65,110 cars during the year.

The results from the rating of engines on a tonnage basis, referred to in previous reports, continue to give satisfaction. The average tons per draft increased 8.4, or 1.15 per cent., and the average tons per car increased 1.3, or 5.51 per cent. The train load last year was 335.46 tons; the tons per loaded car were 15.78.

Acetylene Gas.

A European exchange tells the fact that an acetylene gas lamp exploded last March on a train going from Aix-la-Chapelle to Berlin. The lamp was in a first class compartment, which, fortunately, happened to be empty.

The Sanitary District, Chicago, Water Power.

Last week we noted the report of the Chicago Civic Federation objecting to the Sanitary District leasing the undeveloped water power at Joliet, Ill., to a private corporation. The bids for this power were opened by the District Trustees August 23; only two were received and no bid was made by the city. Clarence Buckingham, Chicago, offered $5 a horse-power a year for a 50-year franchise, while John Norton, of Joliet, bid $4 a horse-power for a ninety-nine year franchise. The estimate of the Civic Federation was that to develop the water power at Joliet would make the cost of current about $15 a horse-power a year in Chicago on a 24-hour basis, while it now costs the city more than $30 a horse-power to develop current by a steam plant for lighting purposes; this being on a basis of 10½ hours a day. The bids were referred to the Committee on Engineering and the whole matter has been held up indefinitely.

Consolidation of Electric Roads.

The Hamilton Street Ry. Co., the Hamilton Gradial Electric Ry. Co., the Hamilton & Dumas Street Ry. Co., the Hamilton Electric Light & Power Co., the Electric Power & Mfg. Co., of Hamilton, and the Cataract Power Co., of Hamilton, have consolidated under the general name of the Hamilton Electric Light & Cataract Power Co., but the companies will be as formerly under independent management.

LOCOMOTIVE BUILDING.

The Intercolonial of Canada has ordered five locomotives from the Canadian Locomotive & Engine Co.

The Cooke Locomotive & Machine Works are building five consolidation engines, with 21 in. x 26 in. cylinders, for the Louisville & Nashville, in addition to the order referred to last week.

The Omaha, Kansas City & Eastern and Omaha & St. Louis roads have appropriated $125,000 for new equipment and buildings, and it is likely that some new locomotives will be bought.

The four locomotives noted in our issue of Aug. 18 as ordered of the Baldwin Locomotive Works by the Kansas City, Pittsburgh & Gulf, are for use on the Kansas City & Northern Connecting.

The Little Rock & Hot Springs Western has ordered two locomotives from the Rogers Locomotive Co. They will be 10-wheelers, with 20 in. x 26 in. cylinders, 61 in. driving wheels and wagon top type of boilers.

The one locomotive ordered by the Mississippi River & Bonne Terre from the Richmond Locomotive & Machine Works, as stated last week, is for October delivery and will be of the consolidation type, with 20 in. x 24 in. cylinders; 50 in. driving wheels; extended wagon top type of boiler with 275 charcoal iron tubes 2 in. in diam. and 13 ft. 1½ in. long; and a working steam pressure of 200 lbs.; the firebox will be of Carbon steel and the special equipment includes Westinghouse brakes, Janney couplers, Crosby safety valves, Nathan lubricator, Scott springs and Midvale driving wheel tires.

The 30 locomotives ordered by the Erie from the Rogers Locomotive Co. and referred to in our issue of Aug. 18, will be of the consolidation type, with 21 in. x 28 in. cylinders; 57 in. driving wheels; Wootten boilers with 305 charcoal iron tubes, 2 in. in diam. and 14 in. long and a working steam pressure of 200 lbs.; fireboxes, steel, 114 in. long and 96 in. wide; and a tender capacity for 6,000 gals. of water and 12 tons of coal. The locomotives will weigh 170,000 lbs. with 150,000 lbs. on the driving wheels, and have Westinghouse air brakes, hammered steel axles, Gollmar bell ringers, National hollow brakebeams, Janney couplers, 23 in. Kelly headlights, No. 10 Metropolitan injectors, 3 in. Consolidated muffled safety

valves, Leach sanding devices, Nathan lubricators, French springs, Ashcroft steam gages, Latrobe driving wheel tires and Paige 30 in. truck wheels.

CAR BUILDING.

The Chicago & Eastern Illinois will order 500 coal cars.

The Baltimore & Ohio Southwestern is considering buying 1,000 or more box cars.

The Florence & Cripple Creek has ordered 100 box cars from the American Car & Foundry Co.

The Missouri Pacific has ordered 30 passenger coaches from the American Car & Foundry Co.

The Omaha, Kansas City & Eastern and Omaha & St. Louis roads will buy some new equipment.

The Great Northern has ordered from the Pressed Steel Car Co. 400 steel cars of 100,000 lbs. capacity.

The Baltimore & Ohio has placed an order with the South Baltimore Car Works for 1,200 box cars.

The Pennsylvania has asked bids on a number of freight cars of different classes to fill vacant numbers.

The Flint & Pere Marquette has ordered 300 coal cars, of 60,000 lbs. capacity, from the American Car & Foundry Co.

The Southern Railway has increased its order with the American Car & Foundry Co. from 1,000 to 1,500 box cars.

The 100 coal cars for the Chicago Great Western noted in our issue of Aug. 25, will be built by Pullman's Palace Car Co.

The Chicago & West Michigan has ordered 100 furniture cars, referred to in our issue of Aug. 11, from the American Car & Foundry Co.

The Burlington, Cedar Rapids & Northern order for 400 box cars, noted last week, has been placed with the American Car & Foundry Co.

The Kansas City, Pittsburgh & Gulf has ordered 10 passenger coaches from the American Car & Foundry Co., to be built at the Ohio Falls works.

The Mather Horse & Stock Car Co., Chicago, has ordered 130 stock cars of the Southern Car & Foundry Co. through its Chicago agents, Harvey & Fortiner.

The Pennsylvania Lines West of Pittsburgh has placed an order with the American Car & Foundry Co. for the 500 box cars and 500 coal cars noted last week.

The 50 coal cars, of 80,000 lbs. capacity, and the 50 furniture cars for the Vandalia Line, noted in our issue of Aug. 18, will be built at Terra Haute, Ind., by the American Car & Foundry Co.

Aug. 11 we stated that the American Linseed Oil Co. had ordered 50 tank cars from the American Car & Foundry Co., to be built at Milton. This order has since been increased to 100 cars, all to have a capacity of 8,000 gallons of oil.

The eight chair cars and four coaches which Pullman's Palace Car Co. is building for the Chicago, Burlington & Quincy will be 60 ft. long over end sills and 9 ft. 8 in. wide over side sills. The special equipment includes Westinghouse air brakes, Congdon brake shoes, Standard steel tired wheels, French springs, Janney couplers, Baker heaters, Pintsch gas lighting apparatus, and curtains of Pantasote with Forsyth fixtures.

The 2,000 steel coal cars of 100,000 lbs. capacity ordered by the Erie from the Pressed Steel Car Co., and referred to in our issue of Aug. 18, are for delivery commencing in January next and will measure 30 ft. long and 9 ft. 6 in. wide inside and 10 ft. high from rail to top. The specifications call for Schoen pressed steel bolsters, solid pressed steel brakebeams, Westinghouse brakes, Brady Metal Co.'s brasses, Schoen design draft rigging, cast iron journal boxes with pressed steel lids, M. C. B. couplers, coil springs, Schoen pressed steel diamond trucks and 33 in. 650 lb. wheels.

BRIDGE BUILDING.

BELLEFONTE, PA.—The bridge on Willowbank Street has been condemned by the engineers and the court will be asked to authorize a new one in its place.

BIRMINGHAM, ALA.—The County Commissioners of Jackson County have ordered new bridges built as follows: Larkin's Ford, Jones Creek, Widows Creek, near Bolivar, Hindshow's, near Kyle Springs.

BROOKVIEW, Md.—The iron bridge to cross the Nanticoke River at Brookview will be built by the Pittsburgh Bridge Co., the contract price being $6,950.

BROOKLYN, N. Y.—The new Carroll Street and Washington Avenue drawbridges will be worked by electricity, the contracts having been let to the General Electric Co. for $1,971 and $1,694 respectively. But three other draws in Brooklyn are worked by electricity.

ERIE, PA.—A new bridge is reported as being needed at Twenty-third and Parade streets over Harrison Run. The matter has come before the Council and been referred to the Streets Committee.

LEWISTON, IDAHO.—Negotiations are pending to build a bridge across the Clearwater River, connecting Lewiston with the newly purchased depot grounds of the railroad in North Lewiston on the north bank of the River.

MADERA, CAL.—The Supervisors of Madera County will receive at their office in Madera bids for a new bridge over the Fresno River at the Fresno crossing. C. J. Eubanks, Clerk of the Board of Supervisors.

MODESTO, CAL.—Sealed bids will be received by the Supervisors of Stanislaus and Merced counties up to Sept. 11 for a drawbridge with a trestle and span across the San Joaquin River, near Hills Ferry. The bridge must be completed within one year from date of the approval of the plans—i. e., by July 27, 1900. Bids should be directed to the Clerk of the Board of Supervisors of Stanislaus County.

MONTESANO, WASH.—Bids will be received for building a combination bridge (steel and wood) across the Chehalis River at Black House Ferry. Further information may be had from J. A. Sells, County Auditor, Montesano, Wash.

OAKLAND, MD.—A bridge is to be built over the Castleman River, bids for which will be received up to 2 P. M., Sept. 12, by A. G. Ross, Clerk, Oakland, Md. It is to be an iron structure 81 ft. in length, to cost about $1,500.

OTTAWA, ONT.—The Dominion Government recently voted $60,000 to Ottawa for general improvements, and it is proposed to build a bridge across the Rideau River, also to build two other bridges in the city.

PHILADELPHIA, PA.—The great demand for steel has made it impossible for the Phœnix Bridge Co. to complete on time its contract for the new Gray's Ferry bridge, which should have been finished Aug. 23. Eight months ago the contract was given to this company for $147,000. The east approach and span are finished, but the west approach is under way, and its completion cannot be determined with certainty.

SAN FRANCISCO, CAL.—A resolution has been passed regarding the new bridge across the Southern Pacific near Mt. Vernon avenue, the matter being referred to the City Engineer as to the necessity of building the bridge. If the opinion is favorable the necessary surveys will be made and the bridge may be built.

ST. PAUL, MINN.—The contract has been let for the Wabasha street bridge to the J. G. Wagner Co., of Milwaukee, the bid being for $74,812.50. Other proposals ranged from $81,395 to $77,693. The bids were for the superstructure alone.

STOCKTON, CAL.—Sealed bids will be received up to Sept. 5 for a bridge to cross the Calaveras River in San Joaquin County. All bids must be in accordance with the plans and specifications prepared by the County Surveyor, and must be accompanied by a certificate check of 10 per cent. to the amount of their bids. Mr. Otto Grunsky, Clerk, Stockton, Cal.

An ordinance has been passed authorizing the Board of Public Works to advertise for bids for a bridge across Mormon Channel in Stockton at a cost not to exceed $3,000. I. H. Robinson, City Clerk, may be addressed.

Other Structures.

ALBANY, ORE.—Mr. Frank Crabtree, Clerk, Linn County, Ore., will receive sealed bids up to Sept. 8 for building two cylindrical piers under the Green Ferry bridge over the Santiam River, near Jefferson, Ore. Bond must be given to the amount of the bid. Address Clerk at Albany, Ore.

BIRMINGHAM, ALA.—The Louisville & Nashville has begun building a subway under the road at Greenville, Ala. It will be 300 ft. long, 22 ft. under the tracks and 11 ft. clear.

CEDAR RAPIDS, IA.—The Illinois Central is considering plans for building a $100,000 depot in Cedar Rapids and extending the Manchester Cedar Rapids branch southeast through Davenport, over the Mississippi River on the new bridge, to a connecting point on the main line of the Illinois Central, some place in Illinois.

DANVILLE, VA.—The Southern Railway will replace its old passenger station at Danville, Va., with a more modern structure of brick and stone. Reports state that it is to be completed in about four months.

DES MOINES, IA.—A new brick factory will be built for the Carter Windmill Company by F. M. Hubbell. The building will be erected at the corner of East Third Street and Court avenue, will be two stories high with a frontage of 88 ft. on Court avenue and 132 ft. on Third Street. It will probably be finished by Jan. 1, 1900.

DOUGLASVILLE, GA.—The Southern Railway, according to report, will build a new station to replace the one burned some time ago.

HOBOKEN, N. J.—Plans have been filed for a new office building for the Delaware, Lackawanna & Western Railroad to take the place of the present one, which has stood for more than 50 years at the western end of the depot. The new building will be close to the piers adjoining the train shed. It will be a frame structure two stories high, with an octagonal tower on the side facing the river. The main entrance will face the train shed. It will be triangular in shape, with sides 38 ft. 8in., 139 ft. and 107 ft. 2 in. The present plan is to have on the ground floor an immigrants' room and store room and the offices of the Pullman Palace Car Co. and Union News Co. The second floor will be exclusively used for offices. The estimated cost is $15,000.

JERSEY CITY, N. J.—It is announced that the National Trust Co., which recently bought the Taylor Hotel, will build in its place a large steel building, 77 ft. front and 160 ft. deep, plans for which are being drawn.

NEW HAVEN, CONN.—A new building is to be put up by L. Candee & Co., on land adjoining their present factory. This will be used partly as a generating station and partly for general manufacturing purposes.

NEW YORK, N. Y.—About 4,000 tons of steel have been delivered for use in the New East River bridge, the contracts for which were made in March. Another large shipment will be made in October. The work is progressing without serious delay.

SEATTLE, WASH.—According to report the Northern Pacific will build a large passenger station at Seattle, Wash., and also improve its terminal facilities by new wharves and docks.

TOLEDO, O.—Plans are being drawn for a very large rolling mill to be built at Toledo. Ex-President A. G. Houston, of the Maumee Rolling Mills, is said to be interested.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Atlantic Coast Line.—2½ per cent., on common stock, payable Sept. 13.

Boston & Maine.—Quarterly, 1¾ per cent. on common stock, payable Oct. 2.

Meetings and conventions of railroad associations and technical societies will be held as follows:

American Association of General Passenger and Ticket Agents.—The annual convention will be held at Boston, Mass., Oct. 17.

American Society of Civil Engineers.—Meets at the house of the Society, 220 West Fifty-seventh street, New York, on the first and third Wednesdays in each month, at 8 p. m.

American Society of Railway Superintendents.—The annual convention will be held at Detroit, Mich., beginning Sept. 20. C. A. Hammond, Secretary, Asbury Park, N. J.

American Street Railway Association and Street Railway Accountants' Association of America.—The annual convention is set for Oct. 17, at Chicago, Ill. T. C. Pennington, Secretary, 2020 State St., Chicago.

Association of Engineers of Virginia.—Holds its formal meetings on the third Wednesday of each month from September to May, inclusive, at 710 Terry Building, Roanoke, at 5 p. m.

Association of Railway Superintendents of Bridges & Buildings.—The annual convention will be held Oct. 17, in Detroit, Mich. S. F. Patterson, Secretary, Concord, N. H.

Boston Society of Civil Engineers.—Meets at 715 Tremont Temple, Boston, on the third Wednesday in each month at 7.30 p. m.

Canadian Roadmasters' Association.—The annual convention will be held at Toronto, Sept. 20. J. Drinkwater, Secretary, Winchester, Ont.

Canadian Society of Civil Engineers.—Meets at its rooms, 112 Mansfield street, Montreal, P. Q., every alternate Thursday at 8 p. m.

Central Railway Club.—Meets at the Hotel Iroquois, Buffalo, N. Y., on the second Friday of January, March, May, September and November, at 2 p. m.

Chicago Electrical Association.—Meets at Room 1737, Monadnock Building, Chicago, on the first and third Fridays of each month at 8 p. m. J. R. Cravath, Secretary.

Civil Engineers' Club of Cleveland.—Meets in the Case Library Building, Cleveland, O., on the second Tuesday in each month at 8 p. m. Semi-monthly meetings are held on the fourth Tuesday of each month.

Civil Engineers' Society of St. Paul.—Meets on the first Monday of each month except June, July, August and September.

Denver Society of Civil Engineers.—Meets at 3 Jacobson Block, Denver, Col., on the second Tuesday of each month, except during July and August.

Eastern Maintenance of Way Association.—The annual convention will be held Sept. 26 to 29 at Portland, Me. F. C. Stowell, Ware, Mass., Secretary.

Engineers' Club of Cincinnati.—Meets at the rooms of the Literary Club, 25 East Eighth street, on the third Tuesday of each month, excepting July and August, at 6.30 p. m.

Engineers' Club of Columbus, (O.)—Meets at 12½ North High street on the first and third Saturdays from September to June.

Engineers' Club of Minneapolis.—Meets in the Public Library Building, Minneapolis, Minn., on the first Thursday in each month.

Engineers' Club of St. Louis.—Meets in the Missouri Historical Society Building, corner Sixteenth street and Lucas place, St. Louis, on the first and third Wednesdays in each month.

Engineers' Society of Western New York.—Holds regular meetings on the first Monday in each month, except in the months of July and August, at the Buffalo Library Building.

Engineers' Society of Western Pennsylvania.—Meets at 410 Penn avenue, Pittsburg, Pa., on the third Tuesday in each month, at 7.30 p. m.

Locomotive Foremen's Club.—Meets every second Tuesday in the club room of the Correspondence School of Locomotive Engineers and Firemen, 335 Dearborn street, Chicago.

Master Car & Locomotive Painters' Association.—The annual convention will be held Sept. 12 at Philadelphia, Pa. Robert McKeon, Secretary. Kent, O.

Montana Society of Civil Engineers.—Meets at Helena, Mont., on the third Saturday in each month at 7.30 p. m.

New England Railroad Club.—Meets at Pierce Hall, Copley Square, Boston, Mass., on the second Tuesday of each month.

New York Railroad Club.—Meets at 12 West Thirty-first street, New York City, on the third Thursday in each month at 8 p. m., excepting June, July and August.

Northwest Railway Club.—Meets on the first Tuesday after the second Monday in each month at 8 p. m., the place of meeting alternating between the West Hotel, Minneapolis, and the Ryan Hotel, St. Paul.

Northwestern Track and Bridge Association.—Meets at the St. Paul Union Station on the Friday following the second Wednesday of March, June, September and December, at 2.30 p. m.

Roadmasters' Association of America.—The annual convention will be held in Detroit, Mich., Sept. 12. J. B. Dickson, Secretary, Sterling Ill.

St. Louis Railway Club.—Holds its regular meeting on the second Friday of each month at 3 p. m.

Southern and Southwestern Railway Club.—Meets at the Kimball House, Atlanta, Ga., on the second Thursday in January, April, August and November.

Technical Society of the Pacific Coast.—Meets at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., on the first Friday in each month, at 8 p. m.

Traveling Engineers' Association.—The annual convention will be held in Cincinnati, O., Sept. 12. W. O. Thompson, Secretary, Elkhart, Ind.

Western Foundrymen's Association.—Meets in the Great Northern Hotel, Chicago, on the third Wednesday of each month. A Sorge, Jr., 1533 Marquette Building, Chicago, is Secretary.

American Society of Civil Engineers.

A regular meeting will be held Wednesday evening, Sept. 6, at 8.30. Two papers will be presented, namely, "Pile Driving Formulas, Etc.," by Charles H. Haswell, and "The Groined Arch as a Covering for Reservoirs," by Leonard Metcalf. These papers were published in the May issue of the Proceedings.

A meeting will be held Wednesday evening, Sept. 20, at 8.30, at which will be presented a paper on "Insufficient Provision for Counter Stresses in Railroad Bridges," by Henry S. Prichard and a paper on "Comparison of Weights of a Three-Hinged and a Two-Hinged Arch," by C. W. Hudson. These papers are printed in the August number of the Proceedings.

The August number of the Proceedings of the Society contains, besides the two important papers mentioned above, a report in full of the business meeting at the summer convention and a running

account of the convention itself. It also contains a long list of recent engineering articles as published in the technical journals covering the ground from May 10 to Aug. 7, also a list of new books.

Another paper published in the August Proceedings of the Society, is "Impact Tests of Structural Steel," by S. Bent Russell. This will be presented at the meeting of Oct. 4. The same issue contains discussions on a number of different topics at the convention and on papers which have been presented at earlier meetings.

PERSONAL.

(For other personal mention see Elections and Appointments.)

—The reports which come concerning the health of Mr. H. Walter Webb are not at all encouraging. The latest accounts that we have seen indicate progressive failure.

—Charles Whittier died on Monday at his home in Rosbury, Mass. He was President of the Whittier Machine Company, a member of the American Society of Mechanical Engineers, and of many social and charitable organizations. He was one of the vice-presidents of the Eliot Five Cent Savings Bank.

—Mr. C. B. Cox, who has been appointed Superintendent of the Mexican Central Ry., entered railroad service on the Chicago & Northwestern Aug. 1, 1872, at the age of 14. He gradually acquired a general experience in many kinds of railroad work on that line, on the Denver & New Orleans during construction, on the Atchison, Topeka & Santa Fe., on the Mexican Central and later as General Trainmaster on the Interoceanic.

—Mr. Isaac Hopkins Congdon, at one time Superintendent of Motive Power of the Union Pacific, died at Omaha, Neb., Aug. 21. Mr. Congdon was born in Granville, Mass., in 1833, and entered the railroad service in 1851 as Machinist on the Cleveland, Columbus & Cincinnati, now part of the Cleveland, Cincinnati, Chicago & St. Louis. From then, until 1866, when he became General Master Mechanic of the U. P., he served on various roads as Machinist, Foreman Machine Shops and Master Mechanic. Mr. Congdon was the inventor of several railroad appliances, one of which is the Congdon Brake Shoe.

—Mr. C. H. Hutchins, of Detroit, Mich., President of the well known firm of car roof makers, C. B. Hutchins & Sons, was found dead in his room at the Hotel Metropole, Detroit, Saturday morning, August 26. About two weeks ago Mr. Hutchins returned from an Eastern trip and since then had been feeling unusually well. The cause of his death is not stated. Mr. Hutchins was born in Haverhill, Mass., May 1, 1858. When he was 15 years old his parents removed to Ann Arbor, Mich., to educate their children, and the result must have been to them singularly satisfactory. A brother of Mr. C. H. Hutchins, namely, Mr. Harry B. Hutchins, is Dean of the Law Faculty of the University of Michigan, was Acting President of the University during the absence of President Angell as Minister to Turkey, and is a man of distinction. Another brother, Mr. E. R. Hutchins, is president of an important manufacturing concern in Chicago. Mr. C. H. Hutchins was graduated from the University of Michigan in the class of 1878 and then took two years in the law school of the same University and began the practice of law in Owosso, Mich. In 1882 he went to Detroit to engage with his father, the late C. B. Hutchins, in the manufacture of car roofs, after the patents of Mr. Hutchins.

ELECTIONS AND APPOINTMENTS.

Atchison, Topeka & Santa Fe.—J. E. Gorman, heretofore Assistant General Freight Agent, has been appointed General Freight Agent, with headquarters at Chicago, Ill., succeeding F. C. Gay, resigned.

Chicago Great Western.—C. A. Christoferson has been appointed Signal Engineer.

Chicago, Rock Island & Pacific.—W. K. McFarlin, Superintendent Maintenance and Construction, lines east of the Missouri, has resigned. Effective Sept. 12.

Cleveland, Cincinnati, Chicago & St. Louis.—J. S. Sweeney has been appointed Trainmaster of the Chicago Division (East), with headquarters at Riverside, O., succeeding Charles Hine, resigned.

Cleveland, Lorain & Wheeling.—W. R. Woodford, General Manager, has geen elected President, succeeding M. D. Woodford.

Delaware, Lackawanna & Western.—W. K. McFarlin, heretofore Superintendent of Maintenance and Construction, lines east of the Missouri, of the Chicago, Rock Island & Pacific, has been appointed Chief Engineer of the D., L. & W., succeeding James Archibald.

Evansville & Terre Haute.—A. C. Hone has been appointed Superintendent Motive Power and Rolling Stock, succeeding John Torrance, deceased.

Findlay, Fort Wayne & Western.—Charles Hine has been appointed General Superintendent, with headquarters at Findlay, O.

Galveston, Houston & Northern.—J. M. Ward has been appointed Master Mechanic, with headquarters at Houston, Tex.

Great Northern.—C. P. Adams, Superintendent of Telegraph, with headquarters at St. Paul, Minn., has resigned. C. F. Sewell has been appointed Trainmaster.

Interoceanic of Mexico.—Louis Greaven, formerly with the Buenos Ayres Western, has been appointed Locomotive and Car Superintendent of the I. O. M., succeeding H. E. Walker, resigned. Mr. Greaven will assume his new duties upon his return from Europe in October.

Indianapolis Southern.—The officers of this company referred to in the Construction column are: President, D. M. Parry; Vice-President, John E. McGetigan; Treasurer, W. E. Stevenson; Secretary, Chas. E. Barrett. The main office is Indianapolis, Ind.

Iowa Central.—L. M. Martin, General Manager, with headquarters at Marshalltown, Ia., has resigned. Mr. Martin will, however, remain with the company indefinitely in some other capacity.

Little Rock & Hot Springs Western.—The officers of this company referred to in the Construction column are: President, S. W. Fordyce, St. Louis, Mo.; Vice-President, John G. Lonsdale, Hot Springs, Ark.; Secretary, Wm. S. Mitchell, Little Rock, Ark.; Chief Engineer, Henry G. Fleming, Little Rock, Ark.; Treasurer, S. W. Fordyce, Jr., St. Louis, Mo.

New Orleans & Western.—The Board of Directors for the new company to be organized under the reorganization plan is as follows: Stephen Peabody, Wm. L. Bull, Evans R. Dick, George Quintard Whitney, James T. Hayden, W. C. Dotterer, Charles B. Van Nostrand and two residents of New Orleans, to be nominated by such of above directors as are residents of that city.

Pittsburgh, Shawmut & Northern.—The officers of this company, including those mentioned under Elections and Appointments (Aug. 11, p. 575), are: General Manager, B. E. Cartwright; General Superintendent, M. S. Blair; Assistant Treasurer and Auditor, Henry S. Hastings; General Freight and Passenger Agent, Charles H. Hammond; Assistant General Freight and Passenger Agent, L. P. Snyder; Chief Engineer, W. B. Parsons and Master Mechanic, L. B. Heers.

San Francisco & San Joaquin Valley (Atchison, Topeka & Santa Fe).—At a meeting of the stockholders, held Aug. 21, the following officers were elected: Chairman of the Board, J. D. Spreckels; Assistant Secretary, L. C. Deming, New York; Treasurer, G. Holterhoff, Jr., Los Angeles, Cal.; Assistant Treasurer, H. W. Gardiner, New York; General Auditor, H. C. Whitehead, Chicago, Ill.; General Counsel, Victor Morawetz, New York; Comptroller, J. P. Whitehead, New York, and General Solicitor, C. N. Sterry, Los Angeles, Cal. W. A. Bissell was elected a Director, succeeding H. C. Bush, who was temporarily elected a Director at the annual meeting in July.

St. Louis, Kennett & Southern.—J. J. Kress has been appointed Assistant Superintendent, with headquarters at Kennett, Mo.

Southern Pacific.—S. F. B. Morse, heretofore General Passenger Agent of the Atlantic System at New Orleans, La., has been appointed Assistant Passenger Traffic Manager, with headquarters at Houston, Tex.

Union Pacific.—John McFarlane has been appointed Assistant Superintendent, with headquarters at Ellis, Kan., succeeding W. H. Petersen, resigned.

Wheeling & Lake Erie.—The headquarters of F. C. Gates, Purchasing Agent and Superintendent of Telegraph, have been removed from Toledo, O., to the "Arcade Building," Cleveland, O.

White Pass & Yukon.—S. M. Irwin has been appointed General Traffic Manager, succeeding L. H. Gray, resigned.

RAILROAD CONSTRUCTION,
New Incorporations, Surveys Etc.

ARIZONA ROADS.—The Helvetia Company, according to report, is considering the building of a railroad from Santa Rita Camp to Tucson, on the Southern Pacific.

BALTIMORE & OHIO.—Surveys have been made for a new line in Marshall County, W. Va., to the Ohio River, and thence to Moundsville, about 40 miles, to avoid heavy grades between Littleton and Moundsville. A rough report shows that there will be no opposing grades to westbound traffic, and very easy grades in the opposite direction. There will be required one or two short tunnels and a number of bridges across Fish Creek, which, near the Ohio, is quite a large stream. The preliminary work is not yet completed and nothing definite is determined as to building. (Official.)

BOSTON & MAINE.—The company has decided, according to report, to build the extension from Manchester, N. H., southwest about 10 miles, via Bedford Center and Amherst, to Milford, to connect with the Fitchburg. (June 2, p. 393.)

BUTTE, ANACONDA & PACIFIC.—Extensive improvements are being made on this line, including ballasting from Anaconda to Butte; the raising of the track from eight inches to 3 ft. at various points, and the building of a yard at Silver Bow, Mont.

CALIFORNIA ROADS.—Harry T. Compton of Stockton, Cal., heads a surveying party for a new line from Stockton north to Sacramento. It is denied that the Atchison, Topeka & Santa Fe has any connection with the proposed line.

CANADIAN NORTHERN.—The Ontario & Rainy River line has been graded for several miles west of Stanley, Ont. A large number of men are at work, but there is considerable difficulty in obtaining workers at the rate of $1.75 per day. There are 75 miles under contract and an additional 40 miles has been let to McGillivray & Lesson of Calgary, to be completed by July 1, 1900.

Rails are being laid from Bonner's Ferry, Ida., north on the Kootenay Valley line to Kootenay Lake, B. C., 52 miles. Foley Bros., Larson & Halverson of St. Paul, are the contractors. (June 23 p. 461.)

CANADIAN PACIFIC.—Trains began running Aug. 11 as far as Cascade, B. C., on the Columbia & Western extension from Robson, west 105 miles to Midway. Mann, Larson & Foley Bros. are the principal contractors. (May 5, p. 323.)

CHICAGO & NORTHWESTERN.—Grading is reported completed and rail laying in progress on the Minnesota & Iowa extension from Burt, Ia., northwest 92.5 miles to Sanborn, Minn. Winston Bros., Minneapolis, Minn., have the contract. (March 17, p. 197.)

CHICAGO, ROCK ISLAND & PACIFIC.—Grading is reported in progress for the Enid & Tonkawa extension from North Enid, Okla., northeast toward Tonkawa, about 30 miles. The terminal is to be a new town not yet exactly located. (Aug. 11, p. 575.)

DENVER & RIO GRANDE.—Track laying is to be begun at once, according to report, on the Rio Grande, Pagosa & Northern extension from Gato, Colo., northeast about 30 miles to Pagosa Springs. (Aug. 11, p. 575.)

GRAND TRUNK.—A new line is projected to run from Brockville, Ont., on the G. T. R., north about 60 miles, via Smith's Falls, to Ottawa. Geo. Kidd, of the firm of Kidd & Jones, Ottawa, represents the project. It is said to be backed by the G. T. R.

C. M. Hays, General Manager, is reported as stating that active work is being pushed on double tracking the main line at Murray Hill. When this is completed, 333 miles of line between Toronto and Montreal, with the exception of about 46 miles from Newtonville to Scarboro Junction, will be double track.

GREAT NORTHERN.—Surveys are reported in progress for a cut-off from Fairhaven, Wash., south along the water-front to a point near Burlington.

J. F. Stevens, Chief Engineer, has given out the following information relative to the improvements now in progress on his line:

At Minot and Williston, N. D., and Glasgow, Mont., new yards are being built to give 3,000 feet of room. New twenty-stall roundhouses are going up at all of the three places, each to cost $25,000, and a new brick freight and passenger depot is being built at Glasgow that will cost $12,000. The entire Montana division of the line, extending from Minot to Blackfoot, is being reballasted, which gives employment to 800 men, six steam shovels and thirty engines and work trains. On this line thirty new steel bridges are being built and 200 others are being filled and fitted with stone culverts. The work this year alone has resulted in the reballasting of 350 to 400 miles of the track, besides the general widening of the grade and cutting out sags, etc. On the line from Blackfoot to Havre, 150 miles long, thirty miles of new roadbed is being built to lighten the grade. In that vicinity the contract has been let for the construction of two of the largest railroad bridges in America. One of them is 125 feet high and 1,800 feet long, and the other, which will be the highest wooden bridge on the continent and probably in the world, will be 214 feet high, and has a total length of 1,000 feet. This latter is to be at Two Medicine. These bridges will require 2,300 tons of steel and will cost from $180,000 to $200,000. Along this same road two short stretches of eight or nine miles are being made to cut out the curves. The line from Havre to Great Falls is being entirely rebuilt for a distance of twenty-four miles, following the Missouri River, to lighten the grade. This will include two new large steel bridges. From 700 to 800 men are being employed in this work. The company is also spending from $75,000 to $100,000 in improvements on the Minneapolis depot, enlarging the general rooms, erecting new baggage rooms, erecting elevators, etc. In Washington $500,000 is being spent in improvements at the Columbia River bluffs in order to dispense with a number of bridges and to eliminate several curves. The road from Monroe to Lowell, in Snohomish County, has been improved to the extent of $600,000 in work during the last few months and in riprapping down the west side of the switchback $190,000 has been expended during the last year or year and a half, all for the purpose of avoiding damage by high water. The Cascade tunnel is finished a distance of 7,000 feet, out of 13,000 feet required before the work is complete, from 500 to 600 men working day and night. This tunnel should be ocmpleted in October, 1900. Its total length will be two and one-half miles, which will save an elevation of 1,000 feet. The contractors will commence lining the tunnel by Sept. 1.

GREAT NORTHERN (Canada).—The extension from Shawenegan west, under the control of Messrs. Ross, Barry & McRae is advancing rapidly. Work is begun on the bridge over the Ottawa River, at Hawkesbury, of which there are seven spans of 204 ft. each. Men have been at work preparing the stone for the bridge for some time, and already 800 cu. yds. of the total 2,700 have been cut and are in position. In addition to this stone work there will be about 2,000 cu. yds. of concrete.

The section from St. Jerome to Hawkesbury, 38 miles, is far advanced. It includes two important bridges near the town of Lachute. Stone is being rapidly quarried for these structures, which are to be completed the present season. The grading is far advanced between Shawenegan and Montcalm, 53 miles, and is fully nine-tenths completed. Rail laying was begun at Joliette about two weeks ago and is progressing rapidly. Right of way has been secured east of Montcalm and for two-thirds of the entire distance west of St. Jerome. It is expected that trains will be running from St. Maurice to Ottawa by next March. (Aug. 18, p. 589.)

HAWAIIAN ROADS.—Rails are on the way for the proposed new Hilo line, to run from Hilo, on the east side of the island of Hawaii, south 15 miles to Hamakona, and eventually to encircle the island. B. F. Dillingham of Honolulu, is President. (May 5, p. 323.)

HIDALGO & NORTHEASTERN.—The Belgian syndicate which owns the Monterey & Mexican Gulf is said to have bought this line and proposes to extend it from Pachuca, Mex., north about 250 miles to Tampico to connect with the M. & M. G. This would make a new through line from northern Mexico to the capital city.

INDIANA, ILLINOIS & IOWA.—It has been determined to make the terminus of the Streator & Clinton extension from Streator, Ill., west, at Bescan, now a flag station on the Chicago, Burlington & Quincy. From that point the tracks of the C. B. & Q. will be used to Fulton. Thence the company will build ultimately to East Clinton. D. D. Streeter of Chicago has the contract. (June 23, p. 461.)

INDIANAPOLIS SOUTHERN.—The proposed route of this line is from Evansville, Ind., northeast via Scalesville, Jasper, Bedford and Belmont, to Indianapolis, with branches from Belmont west to Bloomfield, and from Scalesville to Rockport, in all about 230 miles. Surveys are now in progress. (Aug. 25, p. 603.) The officers are given under Elections and Appointments. (Official.)

LAKE SHORE & MICHIGAN SOUTHERN.—An officer writes that there is no plan contemplated for enlarging the yard at Ashtabula Harbor, O. (Aug. 18, p. 589.)

LAKE TAHOE.—Grading is making rapid progress on this line from Truckee, Cal., south 15 miles to Tahoe City. The road follows close to the river, which it crosses seven times. B. L. Bliss of Carson City, Nev., is President. (July 21, p. 531.)

LEHIGH VALLEY.—A spur about 3,000 ft. long is being built, according to report, in Buffalo, N. Y., to connect with the Stony Point Steel Plant.

Application has been made to the New York State Railroad Commission to build the Lehigh & Lake Erie extension from Tifft Farm to a connection with the main line of the L. V., near Depew. The hearing was adjourned until Sept. 13.

Building is begun, according to report, on a freight yard on the Hackensack, N. J., meadows to accommodate 3,000 cars. It is to be completed by Jan. 2.

LITTLE ROCK & HOT SPRINGS WESTERN.—The route of this company, successor to the Little Rock, Hot Springs & Texas, is from Little Rock, Ark., paralleling the St. Louis, Iron Mountain &

Southern, to a station on that line known as Benton. Thence crossing the tracks of that line southwest to the town of Hot Springs, in all 53 miles. More than half the line is graded. Track laying will be begun about Oct. 15. All supplies are contracted for. The character of the work between Little Rock and Benton is quite expensive. There are heavy cuts and falls, both in loose and solid rock. The maximum grade is 1%; maximum curvature, 6°. There will be 840 ft. of steel and iron bridging. McCarthy & Reichardt of Little Rock have the contract. (Aug. 4, p. 561.) The officers are given under Elections and Appointments. (Official.)

LOUISVILLE & NASHVILLE.—The Huntsville, Ala., Chamber of Commerce, and the Birmingham Commercial Club and Board of Trade are urging this company to build an extension of the Huntsville branch from Oneonta north about 35 miles to Guntersville. At that point it is proposed to build a bridge across the Tennessee River. This will reduce the distance between Birmingham and Huntsville by about 25 miles.

Franchises have been granted for spur tracks and sidings at Cullman, Ala.

MEXICAN ROADS.—Senor Don Luis Aznar Cano, a lawyer of Campeche, Mex., is interested in a plan to build a railroad from Campeche, to run west several hundred miles to the Interoceanic line on the Isthmus of Tehuantepec, to connect with a station called El Juile. A branch is proposed to the Guatemala frontier. It is stated that subscription lists for the road are being rapidly filled.

MISSING LINK.—Col. W. L. Allbright of Ottawa, Putnam County, O., is at Chattanooga, Tenn., perfecting the organization of his company to build a line from Chattanooga east about 150 miles to Walhalla, S. C. (July 28, p. 547.)

MOBILE & WEST ALABAMA.—The citizens of Choctaw County, Ala., are endeavoring to persuade this company to change the line of the old Milner survey to run through their county instead of down the east bank of the Tombigbee River. The line is proposed from Mobile north 350 miles, via Tuscaloosa, to Florence. H. A. Austill of Mobile is President. (Aug. 25, p. 603.)

MONONGAHELA & WASHINGTON.—F. D. Keenan of Atlantic City, N. J., has the contract for this line from Monongahela, Pa., to run west through Washington. Grading is to be begun at once. (Aug. 25, p. 603.)

NORFOLK & WESTERN.—L. H. Vaughan, according to report, has the contract for building six miles of double track between Montgomery and Elliston, Va. It will require changes in two tunnels along the line.

NORTHERN PACIFIC.—The Chief Engineer writes that no authority has been received to build the three extensions referred to two weeks ago (p. 589), namely, from Wheatland, N. D., northwest into Cass County, from Kendrick, Id., northeast about 25 miles up the Potlatch River, and from Wallace, Id., to mines on Sunset Peak.

OMAHA, KANSAS CITY & EASTERN.—Instructions have been given to begin work at once on general improvement of the physical condition of this line between Quincy, Ill., and Council Bluffs, Ia. (Aug. 18, p. 589.) Of the $500,000 to be expended, $375,000 will be used on the roadway, and the remainder in equipment and buildings. (Official.)

OREGON SHORT LINE.—The company, according to report, has made a proposition to the people of Boise, Ida., to build the proposed cut-off of 30 miles from Nampa into that city, providing the people raise $200,000 in cash, and pay for one-half of two bridges to cost in the neighborhood of $60,000. (June 30, p. 483.)

PENNSYLVANIA.—Surveys are reported in progress for a line from Dunlo, Pa., to run north about 15 miles along the base of the Lehigh Mts., to the main line at Cresson. This would take the place of the coal line from Dunlo to South Fork which has severe grades.

PENNSYLVANIA COMPANY.—E. H. France of Bloomville, O., has the contract for 6½ miles of double track on the Cleveland & Pittsburgh between Wheelock, O., and Hudson. Contracts are to be let soon for an additional four miles between Wheelock and the B. Q. tower. (July 21, p. 531.)

PITTSBURGH, SHAWMUT & NORTHERN.—The proposed link of the Central New York & Western from Bolivar, N. Y., north about 15 miles to Friendship, is but one link in the chain needed to complete the connections of the new company. (Aug. 18, p. 589.) The policy will be to connect first the several links from the Shawmut coal fields north to the present connection with the Delaware, Lackawanna & Western at Wayland. (Official.)

QUEEN & CRESCENT.—The Cincinnati Southern has asked permission to extend its tracks in Cincinnati, O., as far as Harrison Ave.

RICE LAKE, DALLAS & MENOMONIE.—Surveys are reported in progress for the proposed extension from Cameron, Wis., north about 32 miles, via Barron, to Menomonie. The road now runs from Rice Lake to Cameron, 7.52 miles. (Jan. 28, 1898, p. 71.)

SALT LAKE & OGDEN.—Preparations are under way, according to report, for building about 2½ miles of the extension from Farmington, Utah, north toward Ogden. (July 14, p. 515.)

SEABOARD AIR LINE.—Surveys are completed for the proposed extension from Charleston, S. C., west about 125 miles to Augusta, Ga., and surveys are in progress for the extension from Athens, Ga., southeast about 100 miles to Augusta. (Aug. 18, p. 589.) When this latter survey is completed, action will be taken relative to building. (Official.)

Surveys are to be begun at once, according to report, for an extension of the Richmond, Petersburg & Carolina from Richmond, Va., north to connect with the Richmond, Fredericksburg & Potomac at Hanover Junction.

SEATTLE & SAN FRANCISCO.—Material is on hand for building this line from near Seattle, Wash., southwest about 30 miles to Palmer, on the Northern Pacific. A portion of the line will be built in conjunction with the N. P. W. E. Guerin of Seattle is President. (Aug. 25, p. 604.)

SIERRA OF CALIFORNIA.—Track is reported laid five miles east of Sonora, Cal., on the extension of this line from Sonora, via Summerville, 20 miles. (April 28, p. 305.)

SMITHFIELD & MASONTOWN.—The Pontiac Construction Co. of Baltimore, Md., and Bennett & Talbott of Greensburg, have the contract for this line of the Federal Steel Co. from Smithfield, Pa., on the Baltimore & Ohio, to run through Fayette County to Masontown, 11 miles. The Baltimore & Ohio is understood to be back of the project. John C. Brennen of Scottdale, Pa., is an incorporator. (Aug. 11, p. 576.)

TENNESSEE CENTRAL.—Track laying was begun last week at Rockwood in Roane County. Grading is completed between Harriman and Monterey, 80 miles. The line, when completed, will run from Knoxville, Tenn., to Nashville. Jere Baxter of Nashville, Tenn., is President. Naugles, Holcomb & Co., 335 Dearborn St., Chicago, have the general contract. (June 30, p. 484.)

TENNESSEE ROADS.—Robert Gray of Bristol, Tenn., Engineer for the Empire Lumber & Mining Co., has asked for bids until Sept. 1 for the proposed line from Fish Dam, Johnson County, to run through Shady Valley and across the Holston Mts. to the Holston Valley RR., 12 miles. (July 28, p. 548.)

TEXARKANA, SHREVEPORT & PACIFIC.—Track laying has reached Hosston, La., 65 miles south of Texarkana. With a level country and no more bridges to build, the company expects to reach Shreveport by the end of this coming month.

TRENTON, LAWRENCEVILLE & PRINCETON.—Maps have been filed with the New Jersey Secretary of State for the second section of this line, which is to run from Lawrenceville northeast to Stony Brook and thence to Princeton, in all 15 miles from Trenton. Jas. L. Branson of Langhorn is President. (July 21, p. 531.)

UNION PACIFIC.—This company is making changes in its freight and passenger tracks at South Omaha, Neb., in connection with its new terminals in that city.

WHITE PASS & YUKON.—Officers of this company announce that the extension is to be built at once from Bennett, N. W. T., north about 98 miles to White Horse Rapids. (Aug. 11, p. 576.)

WINONA & WESTERN.—Location is reported completed for the extension from Simpson, Minn., north about eight miles to Rochester, on the Chicago & Northwestern. It is expected that grading will be begun soon. (April 7, p. 254.)

WISCONSIN CENTRAL.—An officer writes that there is no grade reduction work but that the company is relaying 27 miles of rails east of Chippewa Falls, Wis., and thoroughly ballasting the track and improving the roadbed. (Aug. 18, p. 589.)

GENERAL RAILROAD NEWS.

BALTIMORE & OHIO SOUTHWESTERN.—Franklin S. Buell of Buffalo, N. Y., owner of $121,000 junior bonds, has obtained a temporary injunction restraining the issue of $40,000,000 new bonds under the reorganization plan. (Aug. 25, p. 604.)

BANGOR & PORTLAND.—The directors of this company and of the Nazareth & Lehigh, recently chartered, have decided to merge the two corporations, and the agreement will be ratified by the stockholders at a meeting called for Sept. 7. The N. & L. proposes to build a line from Nazareth, Pa., to connect with the Lehigh Valley and the Central of New Jersey at Allentown or Bethlehem. (Railroad Construction, April 7, p. 253.)

BOSTON & ALBANY.—Official announcement is made that the New York Central & Hudson River, to meet the criticism that under the terms of its proposed lease it might strip the B. & A. and use all its earnings, has offered to insert in the lease a clause providing that it shall not taken any of the earnings of the B. & A. until it shall have paid over to the stockholders of that company, for their own use, another $4,000,000. Proper provisions and safeguards will also be made concerning rate division, accounting and inspection of accounts by the B. & A. directors. The protective committee is reported to have obtained proxies on more than one-third of the stock of the B. & A., which would give it sufficient vote to oppose the lease at its present terms. (Aug. 25, p. 604.)

CANADIAN PACIFIC.—It is proposed to increase the capital stock of the Crow's Nest Pass Coal Co. $10,000,000. Of this, $8,000,000 will be common stock to be issued as a bonus to the holders of the present $2,000,000, which will be preferred. The company expects to be able to pay a dividend on the full issue. Much of the increased earnings is due to the new Crow's Nest Pass Ry.

CHICAGO, BURLINGTON & QUINCY.—Ninety-one 4% bonds of $1,000 each, due Sept. 1, 1921, have been drawn for payment at par Sept. 1, at the New England Trust Co., Boston. (July 28, p. 548.)

COLUMBUS, SANDUSKY & HOCKING.—H. M. Butler, Special Master, has fixed Aug. 29 for proving up bonds in New York City, under the order of the United States Circuit Court for the Southern District of Ohio. Notice is given that all general mortgage bonds claiming prior lien must be deposited on or before Aug. 28 with the North American Trust Co. (Aug. 4, p. 562.)

ERIE.—The annual report for the year ended June 30, 1899, shows the gross earnings to be $33,752,704, an increase of $11,844 over 1898. The working expenses for 1899 were $25,169,926, a decrease of $268,112. This makes an increase in the net earnings for the year of $279,955.

HOCKING VALLEY.—An additional $1,000,000 first consolidated mortgage 100-year 4½% gold bonds of 1899, have been listed in the New York Stock Exchange, making the total $8,200,000. These are to be used for new equipment and for terminal and other improvements under the reorganization agreement. (May 5, p. 325.)

IOWA CENTRAL.—L. M. Martin, General Manager, is reported as stating that negotiations are pending for the absorption of the I. C. by the Chicago, Milwaukee & St. Paul, that a proposition has been made to the C., M. & St. P., and that the matter now rests with that company.

NEW ORLEANS & WESTERN.—The reorganization committee, consisting of Stephen Peabody, Wm. L. Bull, Evans R. Dick and George Quintard Whitney, has prepared a reorganization plan, dated Aug. 1. This provides that the property will be sold under one or both of the mortgages in default and a successor company organized. It shall issue securities as follws: First mortgage 5% 50-year gold bonds to bear interest from Jan. 1, 1900, and redeemable at 110 and interest on three months' notice, $500,000. Preferred stock 5% non-cumulative, subject to call at par on three months' notice, dividends, if earned, to accrue from July 1, 1900, $3,500,000. Of this $2,500,000 is to be exchanged for existing mortgage bonds, and $1,000,000 transferred to the syndicate. Common stock in shares of $100 each, all to be transferred to the syndicate, $1,000,000. The principal of the $2,000,000 first terminal mortgage 5% bonds of the old company, with all unpaid coupons attached, will be exchanged for preferred stock dollar for dollar. The principal of the $1,000,000 second terminal mortgage bonds, with unpaid coupons attached, will be exchanged for preferred stock at 50%. It is intended to arrange with the syndicate to provide $500,000 in cash in return for the other securities. This syndicate will transfer to the new company $500,000 of preferred stock to remain in the treasury until disposed of pursuant to the consent of holders of common stock. The financial agent of the new company in New Orleans is the Whitney National Bank. The new Board of Directors is given under Elections and Appointments.

OREGON RAILROAD & NAVIGATION.—The Northern Pacific has sold its holdings of preferred stock in the O. R. & N. to a syndicate interested in the Union Pacific. The three Northern Pacific officers on the Board of Directors are asked to continue until the next annual meeting.

SIOUX CITY TERMINAL.—This property was sold at public auction at Sioux City, Ia., Aug. 22, to the Trust Company of North America at Philadelphia, the only bidder, for $1,250,000. The property has been in the hands of receivers since Oct. 10, 1893. (Aug. 4, p. 562.)

TRAFFIC.

Chicago Traffic Matters.

Chicago, Aug. 30, 1899.

The Chicago, Milwaukee & St. Paul Company has given notice of its intention to withdraw from membership of the Western Passenger Association. In its notice officers of the road say that by reason of the unfair competition of the Great Western and the non-membership of the Minneapolis & St. Louis and the Wisconsin Central lines, the St. Paul cannot consistently adhere to the rules of the organization and at the same time properly protect itself against these outside lines. There is little criticism of the St. Paul, as all concede that with three Chicago-St. Paul roads without the Western Passenger Association this company cannot protect its revenues and adhere to the rules of the Association. The St. Paul people allege that the Great Western is the greatest offender in rate manipulation. A strong effort is now being made to have the Milwaukee & St. Paul cancel its notice of withdrawal.

Military rates are causing trouble to the lines west of Chicago, and the assessment on this business is likely to go up in the air. The bulk of the westbound movement has gone to the Chicago & Alton, and its competitors are suspicious. The Wisconsin Central has been ousted from the division arrangement on Chicago-Missouri River business because it was suddenly discovered that this system had no Missouri River line. When the agreement was first entered into the Wisconsin Central was guaranteed a percentage of the total westbound soldier business regardless of the fact that it had no Missouri River line. East bound Central Pacific officers are complaining of the methods employed by the Missouri River-Chicago roads in capturing the business from the coast. The Central Pacific people say that eastbound soldier rates must be adhered to as laid down or it will adopt drastic measures to bring the Eastern roads to time.

After Jan. 1, next, a new form of clergy half-fare permits will be used by the roads running east from Chicago, or all of the lines in the Central Passenger Association. In place of the present annual clergy permit each person entitled to the credential will be furnished with a book containing 100 coupons. Whenever a ticket is requested the applicant will be required to fill out one of these coupons in the presence of the selling agent. These coupons will be turned in to the auditors of the respective roads as authority for the sale of the half-rate ticket. In this way an excellent check will be kept on clergymen's signatures, and the work of auditors will be greatly simplified. A nominal charge will be made for the books.

The question of changing the form of interchangeable mileage tickets in the West has been referred by the Western Passenger Association back to the original committee to which the question was first referred. It is desired to increase the mileage of the ticket to 5,000 miles and to provide for a redemption of unused parts of books.

Eastbound shipments of flour, grain and provisions from Chicago and Chicago junctions to and beyond the western terminf of the trunk lines for the four weeks ending Aug. 26, amounted to 437,987 tons. This statement includes 18,378 tons of flour, 353,743 tons of grain, and 65,866 tons of provisions. The following table shows the quantities and proportions carried by the respective roads:

	Tons.	Per Cent.
Baltimore & Ohio	51,001	11.3
Cleveland, Cincinnati, Chicago & St. Louis.	28,591	6.5
Chicago & Erie	43,491	9.7
Grand Trunk	30,119	6.9
Lake Shore & Michigan Southern	59,978	13.7
Michigan Central	64,074	14.9
New York, Chicago & St. Louis	33,423	7.8
Pittsburgh, Cincinnati, Chicago & St. Louis	46,993	10.8
Pittsburgh, Ft. Wayne & Chicago	51,820	11.9
Wabash	28,497	6.5
Totals	437,987	100.0

It is not the opinion of local passenger agents of eastbound roads that the round-trip rates from Chicago to New York will go any lower than the $18.45 figure announced for Sept. 1, 2, 3 and 4. Local representatives of several of the differential lines are of the opinion that they ought to take their usual differential off the $18.45 rate, but it is highly improbable that their executive officers will agree with them.

The Missouri Pacific and Wabash roads have announced that they will meet the cut rates on provisions to the southeast recently announced by the Burlington company, to go into effect Sept. 1. The Burlington's announcement provided for an abolition of the differential on this traffic by other roads to the territory named.